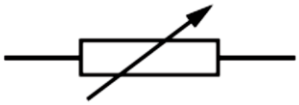
Chapter # 20
Electric Circuits
Circuit diagrams & Circuit components

Q-1: Which electrical component does the symbol represent?



A a fuse **B** a relay coil **C** a thermistor **D** a variable resistor

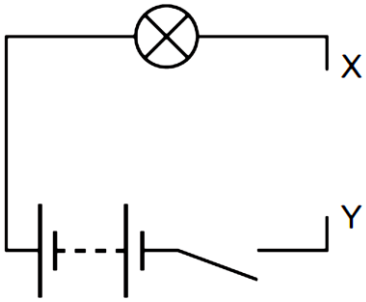
Q-2: Which component is represented by the symbol shown?

A fixed resistor **B** fuse **C** thermistor **D** variable resistor

Q-3: Which circuit symbol represents a component used to measure electric current?

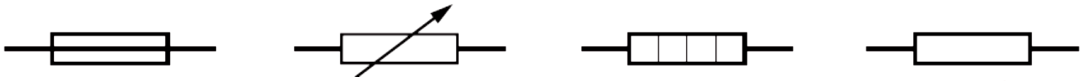
Q-4: A student designs a circuit to turn on a fan when the temperature increases.
Which component does the student need to use in her circuit?

Q-5: A student sets up the circuit shown, with a gap XY.

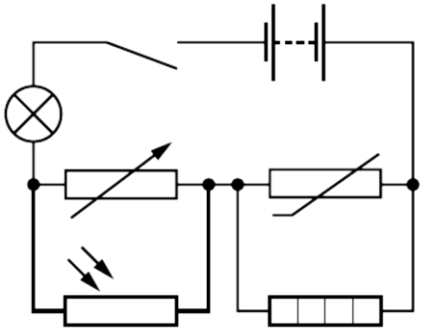


The student wishes to connect a component between X and Y to enable her to vary the brightness of the lamp. Which component should be used?

A B C D



Q-6: The diagram shows a circuit.



What is connected in parallel with the thermistor?

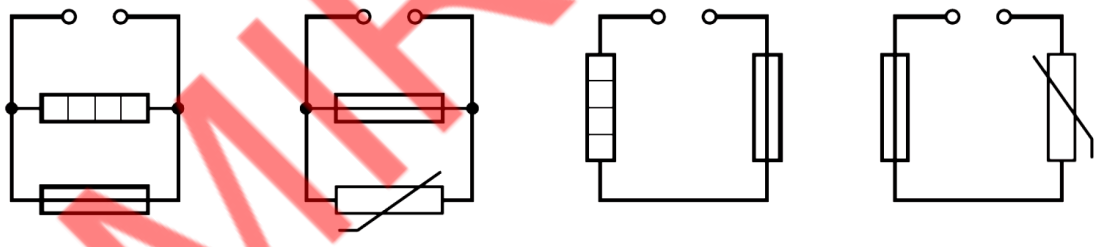
A heater **B** lamp **C** light-dependent resistor **D** variable resistor

Q-7: Which electrical symbol represents a diode?

A B C D

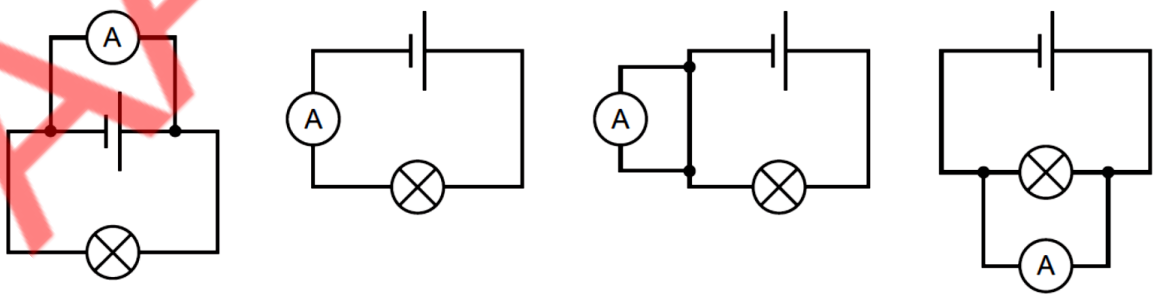
Q-8: A student sets up four circuits. In which circuit is there a heater in series with a fuse?

A B C D

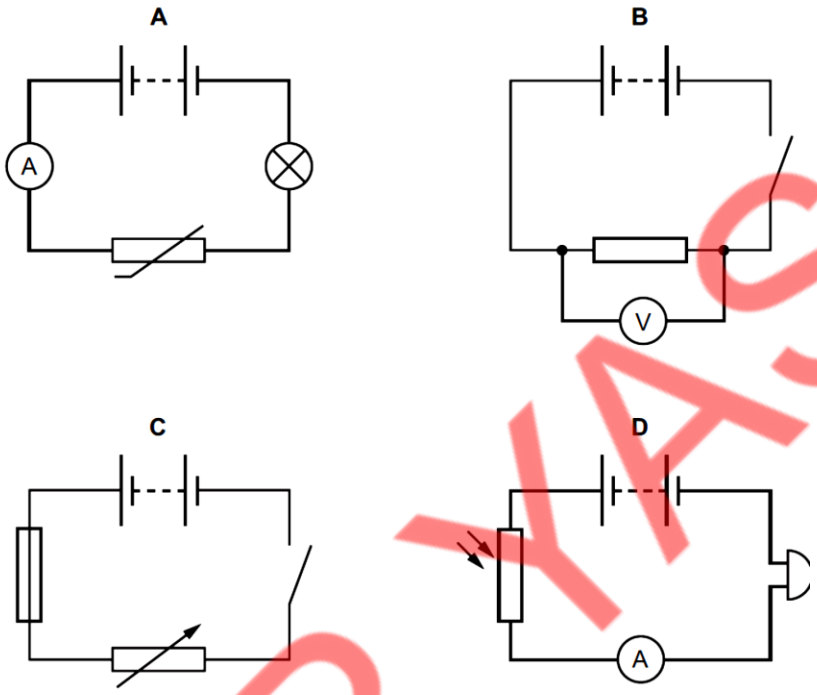


Q-9: In which circuit is the ammeter measuring the flow of charge through the lamp?

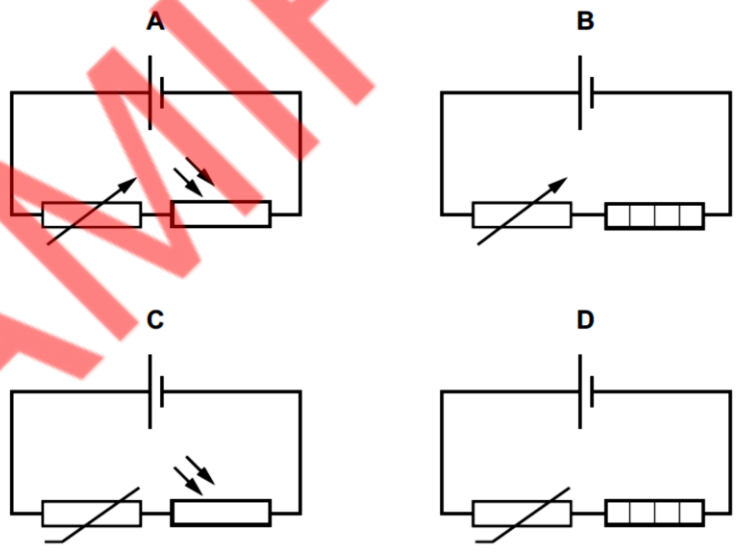
A B C D



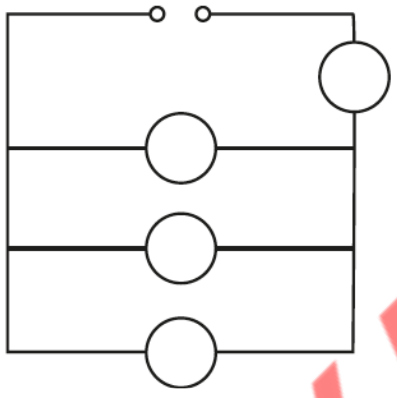
Q-10: Which circuit contains a fuse?



Q-11: Which circuit contains a thermistor and a heater?



Q-12: Fig. 1 shows an incomplete circuit diagram for two identical lamps arranged in parallel. The circuit contains an ammeter and a voltmeter.

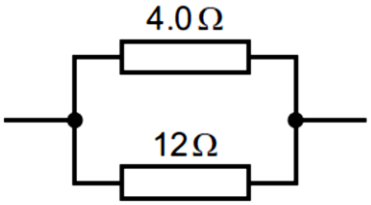


a) On Fig. 1, complete the symbols for two lamps, an ammeter and a voltmeter positioned correctly.

b) One of the lamps breaks. State the effect, if any, this has on the brightness of the other lamp. Explain your answer.

Parallel & Series combination of Resistors

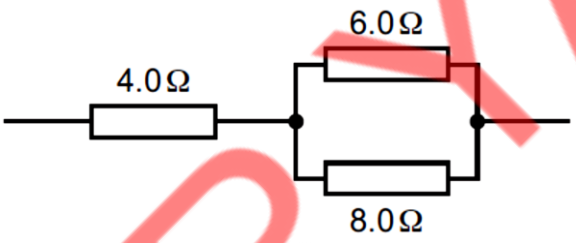
Q-13: A 4.0 Ω resistor and a 12 Ω resistor are connected in parallel.



What is the effective resistance of this combination of resistors?

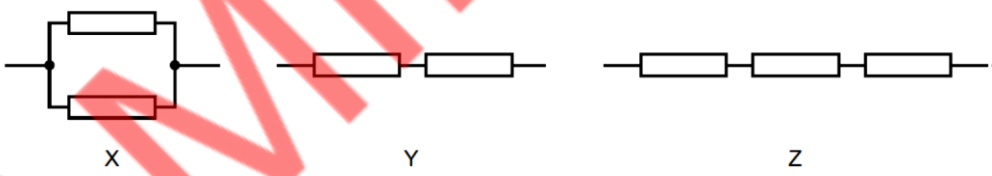
A 0.33 Ω **B** 3.0 Ω **C** 8.0 Ω **D** 16 Ω

Q-14: What is the effective resistance of the following combination of resistors?



A 1.8 Ω **B** 7.4 Ω **C** 11 Ω **D** 18 Ω

Q-15: Identical resistors are connected together to form arrangements X, Y and Z.



What is the correct order of the resistances of the arrangements from the largest to the smallest?

A X →Y →Z
B Y →X →Z
C Z →X →Y
D Z →Y →X

Q-16: Two 10 Ω resistors are connected in series and then in parallel. What is the combined resistance in each case?

	resistance in series / Ω	resistance in parallel / Ω
A	10	5
B	10	10
C	20	5
D	20	10

Q-17: Diagram 1 shows a resistor connected in a circuit. Diagram 2 shows an identical resistor connected in parallel with the first one.

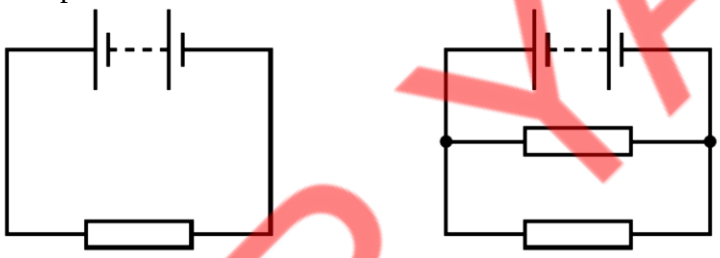
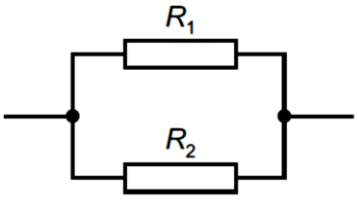


diagram 1 diagram 2

What is the combined resistance of the two resistors?

A greater than in the circuit of diagram 1
B less than in the circuit of diagram 1
C the same as in the circuit of diagram 1
D zero

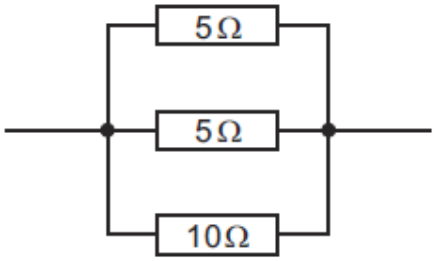
Q-18: Two resistors, with resistances R_1 and R_2, are connected in parallel. The resistance R_1 is greater than the resistance R_2.



What is the resistance of the parallel combination?

A less than either R_1 or R_2
B equal to R_1
C equal to R_2
D the average of R_1 and R_2

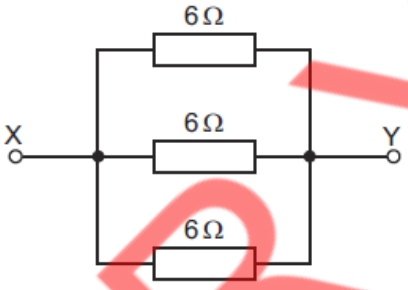
Q-19: The diagram shows three resistors in parallel.



What is the combined resistance?

A 0.50 Ω **B** 2.0 Ω **C** 20 Ω **D** 250 Ω

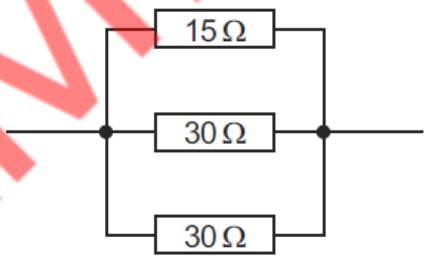
Q-20: A student joins three 6 Ω resistors as shown in the diagram.



What is the total resistance between points X and Y?

A 0.5 Ω **B** 2 Ω **C** 6 Ω **D** 18 Ω

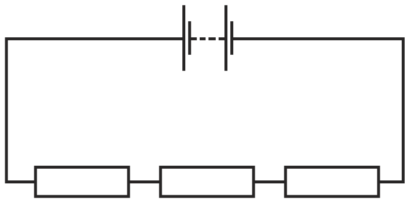
Q-21: The diagram shows three resistors in parallel.



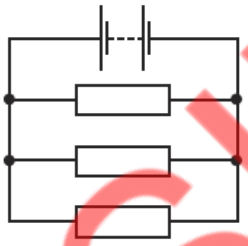
What is the combined resistance?

A 7.5 Ω **B** 15 Ω **C** 30 Ω **D** 75 Ω

Q-22: When three identical resistors are connected in series, their combined resistance is 6 Ω



series



parallel

What is their combined resistance when they are connected in parallel?

A 1/6Ω **B** 2/3Ω **C** 3/2Ω **D** 6 Ω

Q-23: Resistors of 1.0 Ω, 2.0 Ω and 3.0 Ω are connected in parallel with a cell. Which statement is correct?

A The current in each resistor is different but the potential difference (p.d.) across each resistor is the same.

B The current in each resistor is the same but the potential difference across each resistor is different.

C The potential difference across the 3.0 Ω is greater than the potential difference across the 1.0 Ω resistor.

D The sum of the potential differences across each resistor is equal to the electromotive force (e.m.f.) of the cell.

Q-24: Resistors of different resistances are connected to a power supply in either a parallel circuit or a series circuit. Which statement is correct?

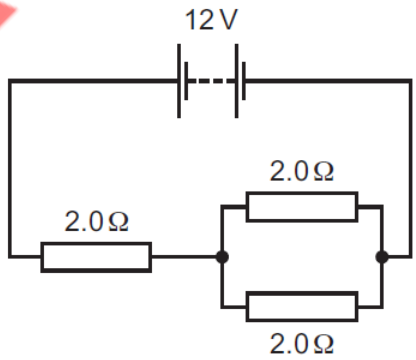
A The current is the same in all resistors connected in parallel.

B The current is the same in all resistors connected in series.

C The voltage across each resistor is different for all resistors connected in parallel.

D The voltage across each resistor is the same for all resistors connected in series.

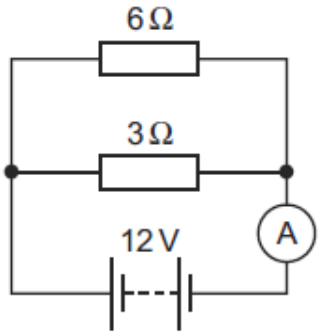
Q-25: A 12 V battery is connected to a combination of 2.0 Ω resistors as shown.



What is the current in the battery?

A 1.5 A **B** 2.0 A **C** 4.0 A **D** 6.0 A

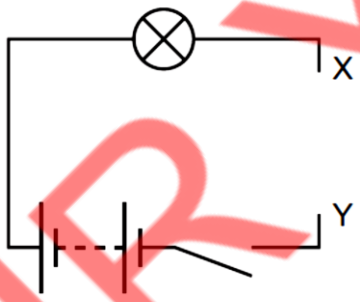
Q-26: A 12 V battery is connected across a parallel arrangement of two resistors.



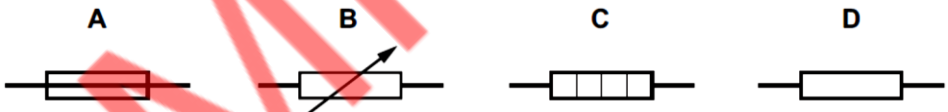
What is the reading on the ammeter?

A 1.3 A **B** 2.0 A **C** 4.0 A **D** 6.0 A

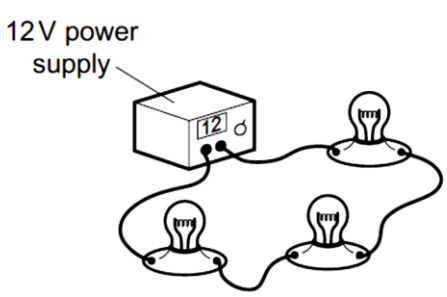
Q-27: A student sets up the circuit shown, with a gap XY.



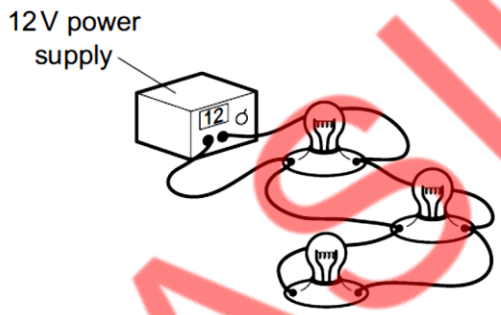
The student wishes to connect a component between X and Y to enable her to vary the brightness of the lamp. Which component should be used?



Q-28: A student is designing a lighting circuit for a dolls' house. He sets up two different circuits. Each circuit contains a 12 V power supply and three identical lamps.
Each lamp is designed to operate at normal brightness when connected individually to a 12 V supply.



circuit 1

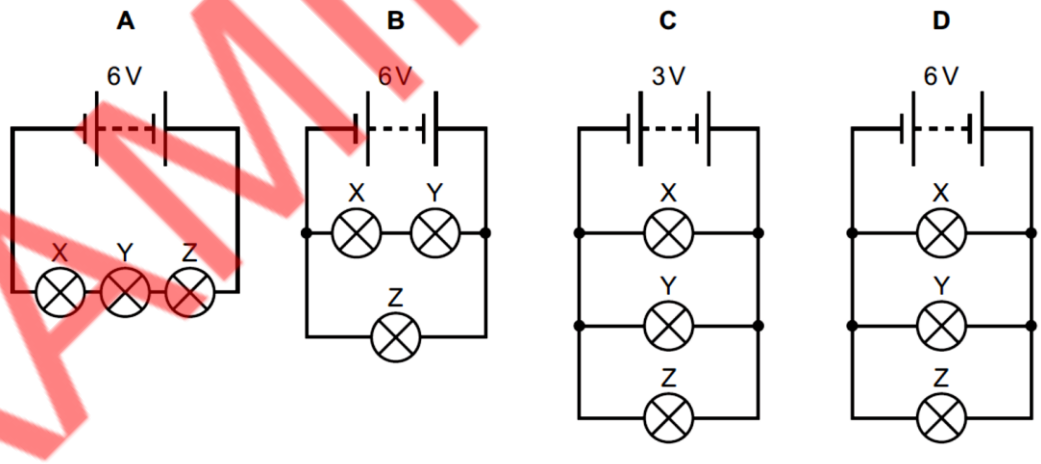


circuit 2

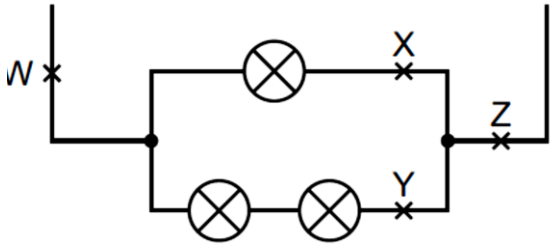
Which statement is correct?

A In circuit 1, each of the lamps is at normal brightness.
B In circuit 1, if one lamp fails, the other lamps remain lit.
C In circuit 2, if one lamp fails, the other lamps remain lit.
D In circuit 2, the current from the power supply is less than in circuit 1.

Q-29: Lamps X and Y are designed to operate at normal brightness when each are connected to a 3.0 V supply. Lamp Z is designed to operate at normal brightness when connected to a 6.0 V supply. In which circuit do all three lamps operate at normal brightness?



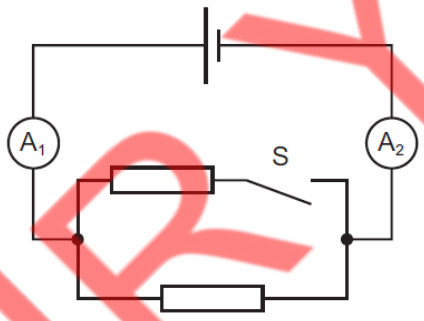
Q-30: The diagram shows part of a circuit containing three identical lamps.



At which two points do the currents have the same value?

A W and X
B W and Z
C X and Y
D Y and Z

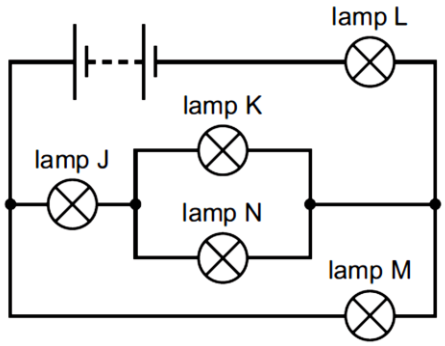
Q-31: In the circuit shown, A_1 and A_2 are ammeters.



Switch S is closed. Which row is correct?

	the resistance of the whole circuit	reading of A_1	reading of A_2
A	decreases	stays the same	increases
B	decreases	increases	increases
C	increases	stays the same	stays the same
D	increases	decreases	decreases

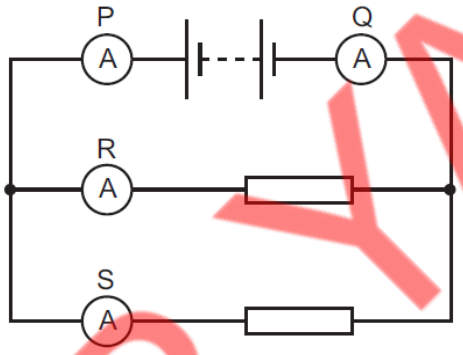
Q-32: The circuit shown contains five lamps J, K, L, M and N. All the lamps are glowing.



One lamp is removed and two other lamps go out. Which lamp is removed?

A lamp J **B** lamp K **C** lamp L **D** lamp M

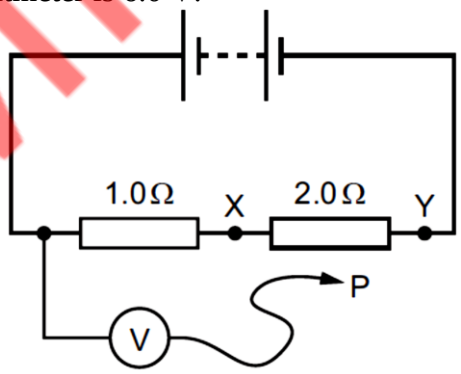
Q-33: A student uses four ammeters P, Q, R and S to measure the current in different parts of the circuit shown.



Which two ammeters read the largest current?

A P and Q **B** P and R **C** R and Q **D** R and S

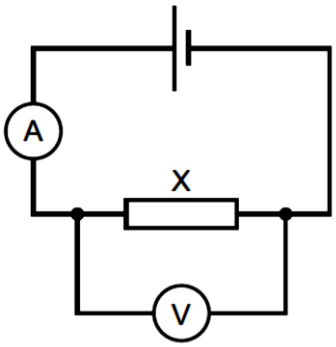
Q-34: The diagram shows a circuit containing two resistors of resistance 1.0 Ω and 2.0 Ω. A voltmeter is connected across the 1.0 Ω resistor by connecting P to X. The reading on the voltmeter is 6.0 V.



P is moved to point Y in the circuit. What is the new reading on the voltmeter?

A 3.0 V **B** 6.0 V **C** 12 V **D** 18 V

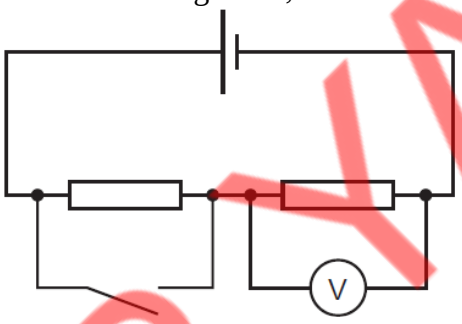
Q-35: A student connects a circuit with a resistor X. The reading on the ammeter is 2.0 A. The reading on the voltmeter is 6.0 V.



She needs to produce a circuit with a total resistance of 10 Ω. Which resistor should she add in series to the circuit?

A 2 Ω **B** 3 Ω **C** 7 Ω **D** 10 Ω

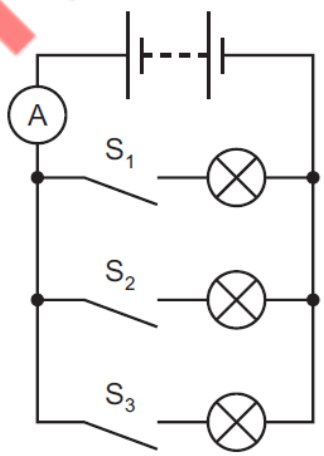
Q-36: The diagram shows a circuit containing a cell, two resistors, a switch and a voltmeter.



When the switch is open the voltmeter reads 1.5 V. When the switch is closed the voltmeter reads 2.0 V. What is the electromotive force (e.m.f.) of the cell?

A 0.5 V **B** 1.5 V **C** 2.0 V **D** 3.5 V

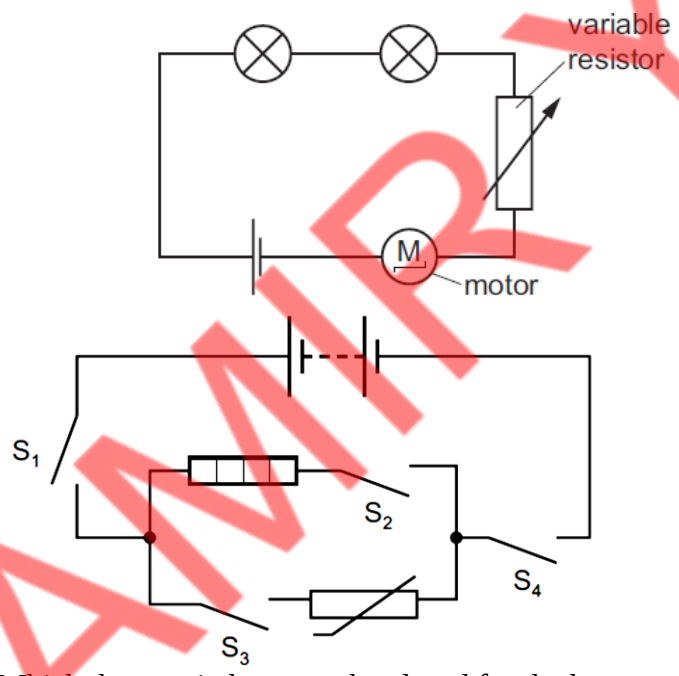
Q-37: The diagram shows a circuit containing a battery, an ammeter, three switches, S_1, S_2 and S_3, and three identical lamps.



With only switch S1 closed, the reading on the ammeter is 0.04 A. Which row states the **incorrect** ammeter reading for the switch conditions given?

	switch S_1	switch S_2	switch S_3	ammeter reading / A
A	open	open	open	0.00
B	open	closed	open	0.04
C	open	open	closed	0.08
D	closed	closed	closed	0.12

Q-38: The circuit in the diagram contains four switches, S1, S2, S3 and S4.



Which three switches must be closed for the heater to work?

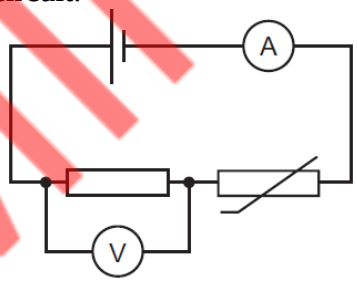
A S1, S2 and S3
B S1, S2 and S4
C S1, S3 and S4
D S2, S3 and S4

Q-39: The diagram shows a simple circuit.

What happens when the resistance of the variable resistor is increased?

A The lamps are dimmer and the motor rotates more quickly.
B The lamps are dimmer and the motor rotates more slowly.
C The lamps have the same brightness and the motor rotates more quickly.
D The lamps have the same brightness and the motor rotates more slowly.

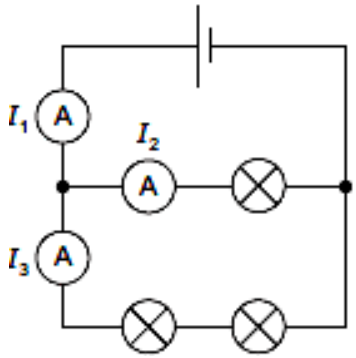
Q-40: The diagram shows a circuit.



What happens to the readings on the voltmeter and on the ammeter when the temperature of the thermistor increases?

	voltmeter reading	ammeter reading
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

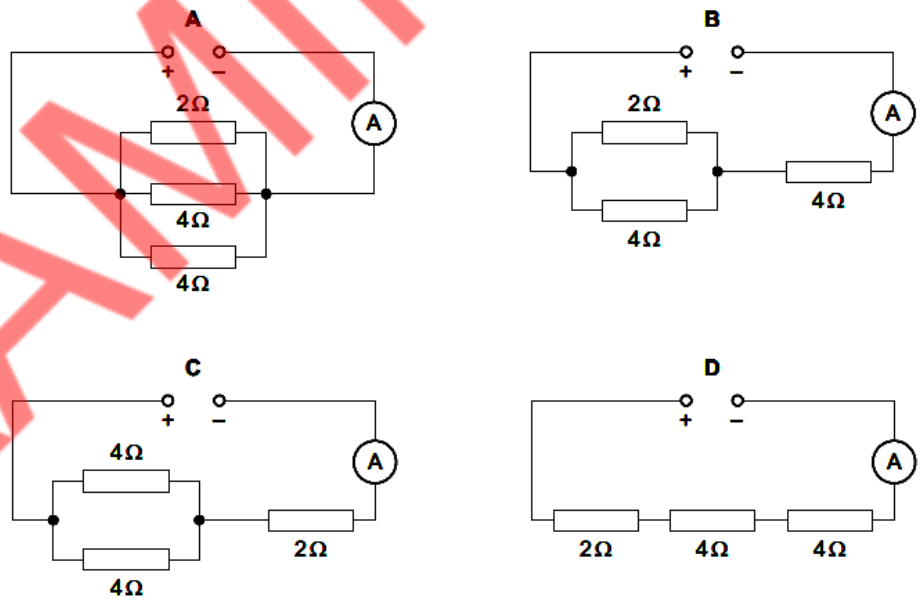
Q-41: Three identical lamps and three ammeters are connected as shown.



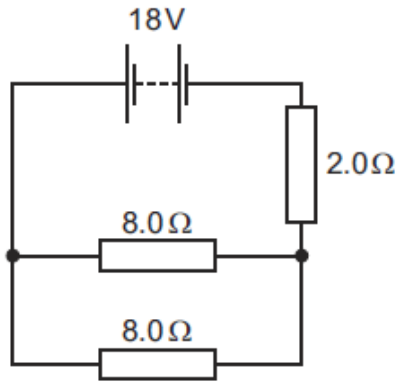
The readings on the ammeters are I_1, I_2 and I_3. How are the readings related?

A $I_1 = I_2 = I_3$
B $I_1 > I_2$ and $I_2 = I_3$
C $I_1 > I_3 > I_2$
D $I_1 > I_2 > I_3$

Q-42: An ammeter is connected to three resistors and a power supply. Which arrangement of resistors gives the greatest ammeter reading?



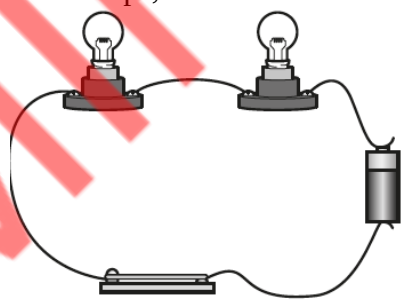
Q-43: A power supply of 18 V is connected to three resistors, as shown



What is the potential difference across the 2.0 Ω resistor?

A 2.0 V **B** 3.6 V **C** 6.0 V **D** 12 V

Q-44: A circuit is made from two lamps, a cell and a switch, as shown in Fig. 1.

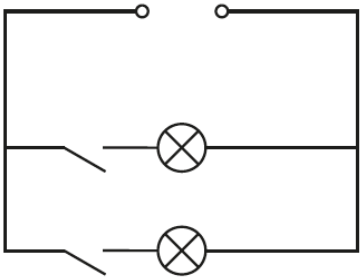


a) **i)** Draw the circuit symbol for a cell.

ii) State the term used for the arrangement of lamps in the circuit in Fig.

iii) The switch is closed and the lamps light. State the name of the charged particles that are flowing through the wires

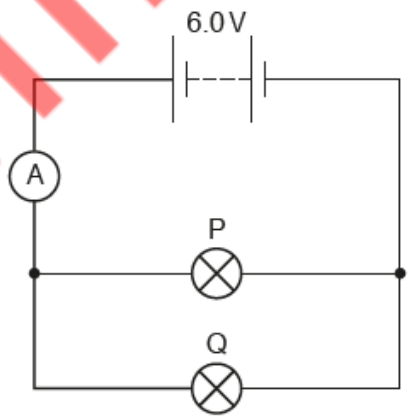
b) Fig. 2 represents a different type of circuit.



i) Compare Fig. 1 and Fig. 2. State **two** advantages of the type of circuit shown in Fig. 2 with the type of circuit shown in Fig. 1.

ii) The potential difference across the power source in Fig. 2 is 3.0 V. The combined resistance of the two lamps is 12 Ω. Calculate the size of the current in the circuit.

Q-45: Two lamps, P and Q, are connected to a battery of electromotive force (e.m.f.) 6.0 V and an ammeter, as shown in Fig. 1.



Lamp P has a resistance of 15 Ω. The ammeter reading is 0.65 A.

a) Calculate the current in lamp P.

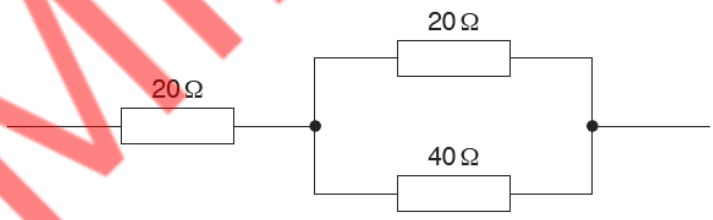
b) Calculate the resistance of lamp Q.

c) The two lamps are now connected in series to the ammeter and the same battery.

i) In the space below draw the circuit diagram.

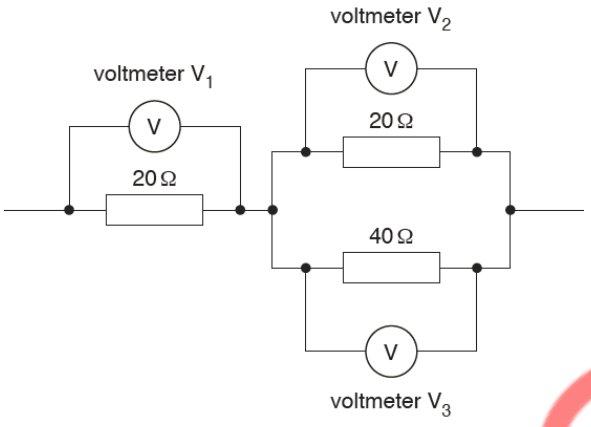
ii) Explain why the ammeter reading is less than 0.65 A when the lamps are connected in series.

Q-46: Fig. 1 shows an arrangement of three resistors.



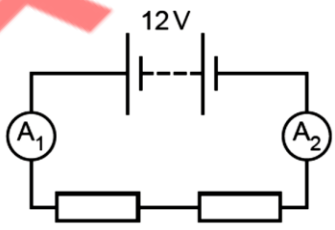
a) Calculate the total resistance of this arrangement.

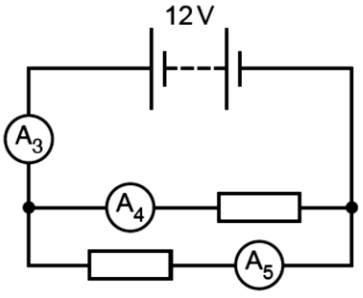
b) The arrangement is connected to a d.c. power supply. Voltmeters are placed across the resistors, as shown in Fig. 2. There is a current in each resistor.



Compare the readings on the three voltmeters. There is no need for any calculation.

Q-47: a) The circuit diagrams in Fig. 1 and Fig. 2 each show two resistors connected to a battery.
Fig. 1 shows two resistors connected in series.
Fig. 2 shows two resistors connected in parallel.
All the resistors have the same resistance. Ignore the resistance of the ammeters.





Compare the currents in the ammeters by completing the sentences.

i) The current in A1 is ..... the current in A2.

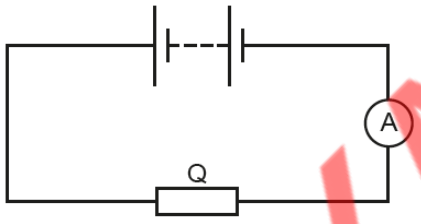
ii) The current in A3 is ..... the current in A4.

iii) The current in A4 is ..... the current in A5.

iv) The current in A1 is ..... the current in A3.

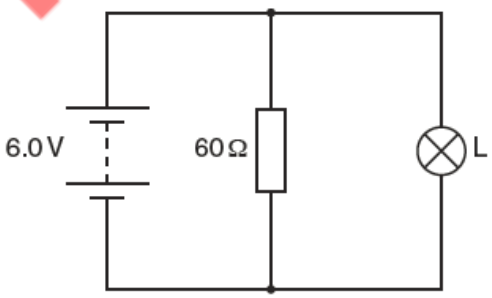
b) The lights in a room are connected in parallel with a power supply. State **one** advantage of connecting the lights in parallel.

c) The circuit diagram in Fig. 9.3 shows a resistor Q connected to a battery.



The current in resistor Q is 0.048 A. The potential difference (p.d.) across resistor Q is 12 V. Calculate the resistance of resistor Q. Include the unit in your answer.

Q-48: Fig. 1 shows a circuit that contains a resistor connected to a power supply of 6.0 V and a lamp L.



The resistor has a resistance of 60 Ω. The lamp is marked 6.0 V, 0.90 W.

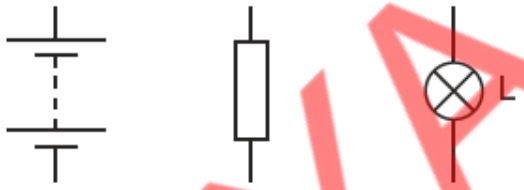
a) Calculate

i) the current in the resistor,

ii) the current in the power supply.

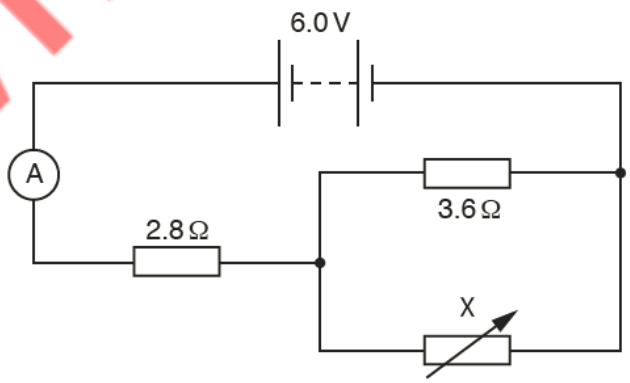
b) A second lamp is added to the circuit shown in Fig. 1. The second lamp is in series with the 60 Ω resistor, but is **not** in series with lamp L.

i) In the space below draw a circuit diagram of this new circuit. The power supply, 60 Ω resistor and lamp L have been drawn for you.



ii) The two lamps are identical. Explain why the second lamp is dimmer than lamp L. A calculation is not required.

Q-49: A student sets up the circuit shown in Fig.1.



The electromotive force (e.m.f.) of the battery is 6.0 V.

a) The resistance of the variable resistor X is set to 1.8 Ω.
Determine

i) the total resistance of the circuit,

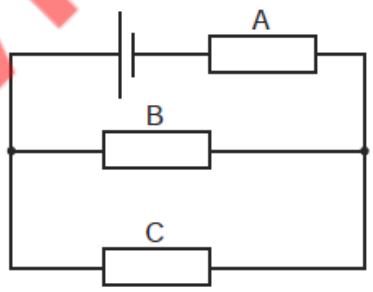
ii) the current measured by the ammeter.

b) **i)** State what is meant by the potential difference (p.d.) across a component in a circuit.

ii) Add to Fig. 1 the symbol for a component that is measuring the p.d. across the 2.8 Ω

iii) The resistance of X is increased.
Explain why the p.d. across the 2.8 Ω resistor decreases.

Q-50: Three resistors A, B and C are connected in a circuit with a cell, as shown in Fig. 1.



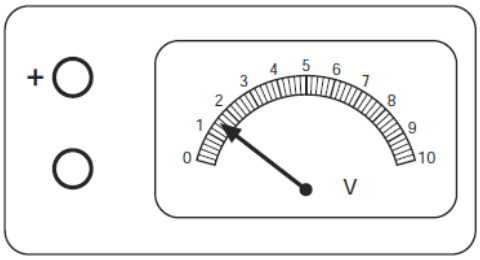
a) State the arrangement of resistors B and C in the circuit.

b) On Fig. 1, draw

i) the symbol for a voltmeter to measure the voltage provided by the cell,

ii) an X to indicate the position of an ammeter to measure the current in resistor A.

c) The voltmeter is shown in Fig. 2.

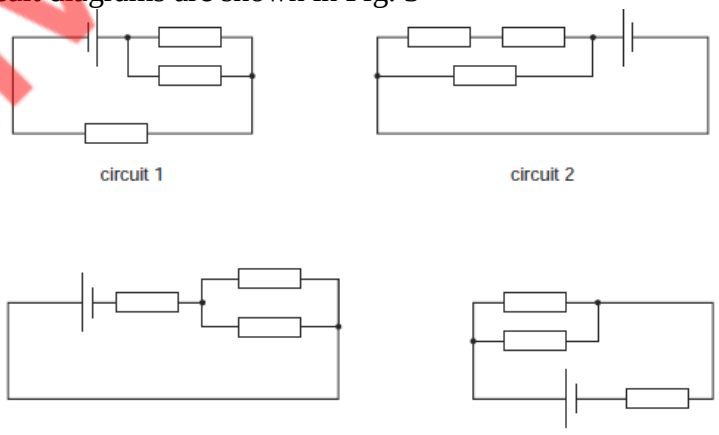


i) State the voltmeter reading V on Fig. 2.

ii) Resistors A, B and C have resistances R_A, R_B and R_C where $R_A = R_B = R_C = 10\ \Omega$.
Use your answer for V in **(c)(i)** and the relationship below to find the value of the current I in resistor A.

$$\frac{V}{I} = R_A + \frac{R_C R_B}{R_C + R_B}$$

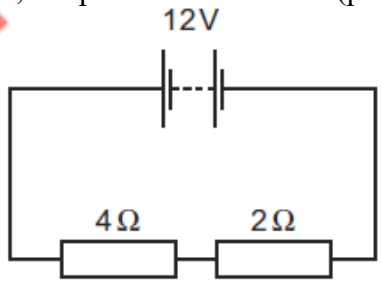
d) Four students try to build the circuit of Fig. 1 with three 10 Ω resistors and a cell. Their circuit diagrams are shown in Fig. 3



State and explain which circuit is **not** the same as the circuit in Fig. 1.

Potential Divider

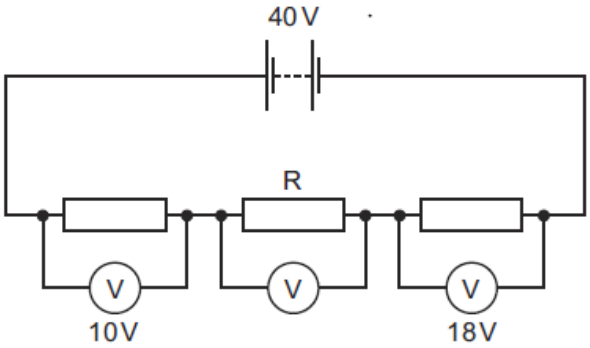
Q-51: In the circuit shown, the potential difference (p.d.) across the 4 Ω resistor is 8 V.



What is the p.d. across the 2 Ω resistor?

A 4 V **B** 6 V **C** 8 V **D** 16 V

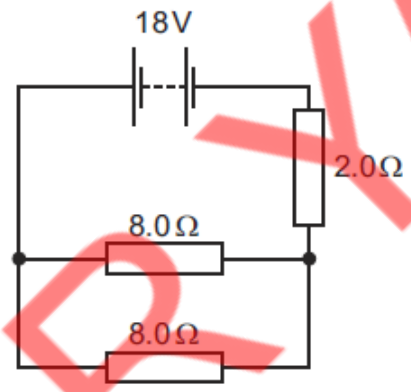
Q-52: The circuit shows three resistors in series connected to a battery. Each resistor has a voltmeter across it and two of the voltages are shown.



What is the potential difference (p.d.) across the resistor R?

A 12 V **B** 22 V **C** 30 V **D** 68 V

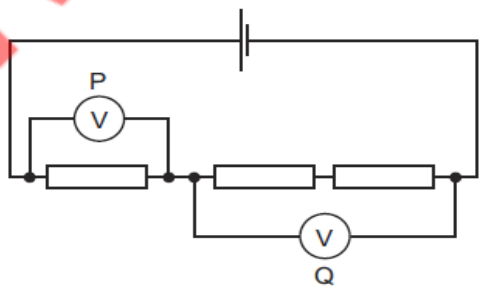
Q-53: A power supply of 18 V is connected to three resistors, as shown



What is the potential difference across the 2.0 Ω resistor?

A 2.0 V **B** 3.6 V **C** 6.0 V **D** 12 V

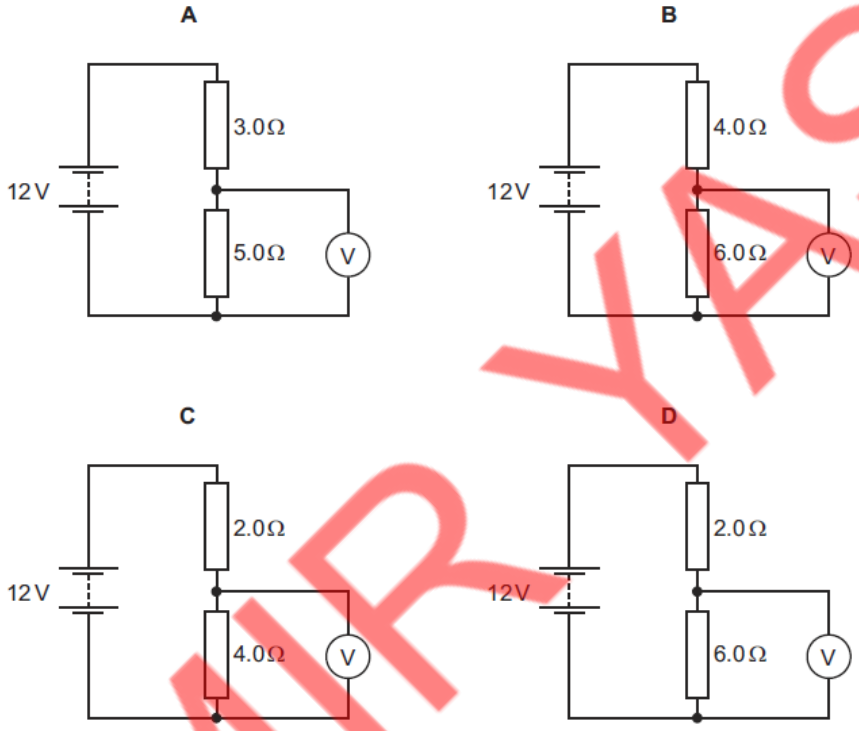
Q-54: Three identical resistors are joined in series to a cell.



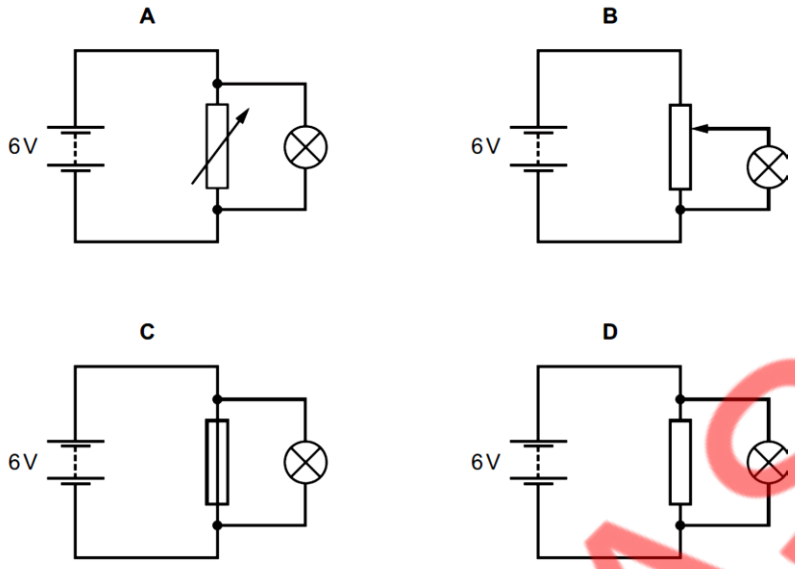
Voltmeter Q reads 8.0 V. What is the reading on voltmeter P and what is the e.m.f. of the cell?

	reading on P / V	e.m.f. of cell / V
A	4.0	8.0
B	4.0	12
C	8.0	8.0
D	8.0	12

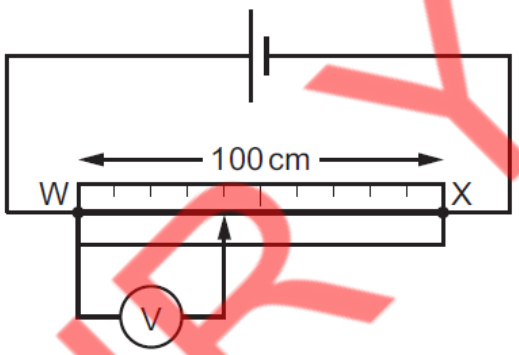
Q-55: In which circuit is the voltmeter reading 7.2 V?



Q-56: A lamp is to be connected in a circuit so that the potential difference (p.d.) across it can be varied from 0 to 6 V. Which circuit would be most suitable?



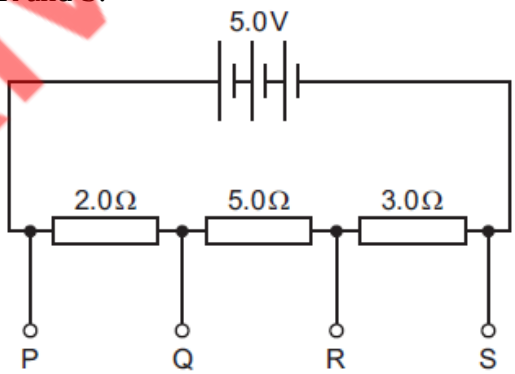
Q-57: The circuit shows a wire WX connected to a cell.



The potential difference (p.d.) between W and X is 1.5 V. What is the reading on the voltmeter?

A 0.4 V **B** 0.6 V **C** 0.9 V **D** 4.0 V

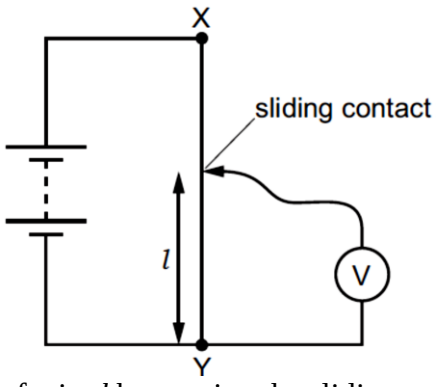
Q-58: The diagram shows a circuit with a 5.0 V power supply, three resistors and four output terminals P, Q, R and S.



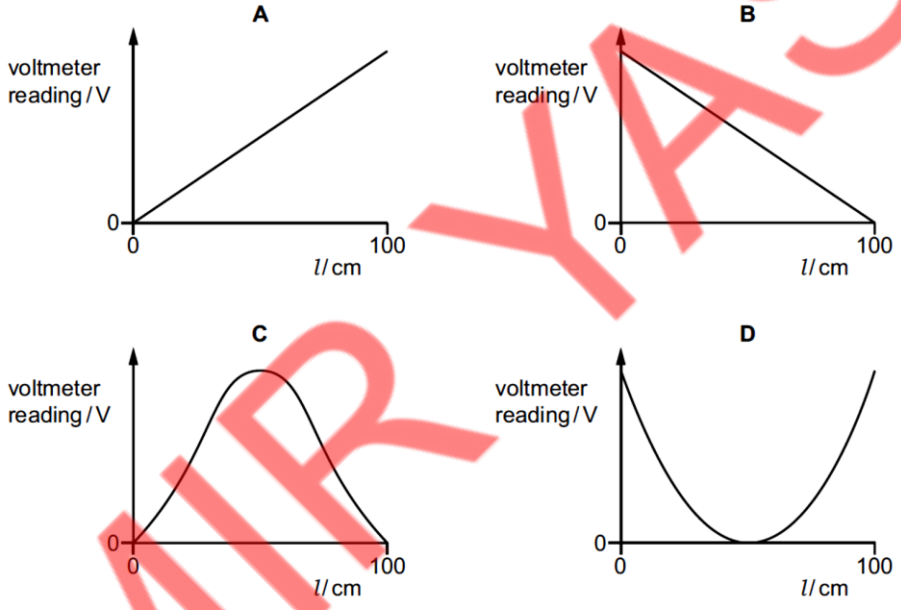
Between which pair of terminals is there a potential difference of 1.5 V?

A PQ **B** PR **C** QS **D** RS

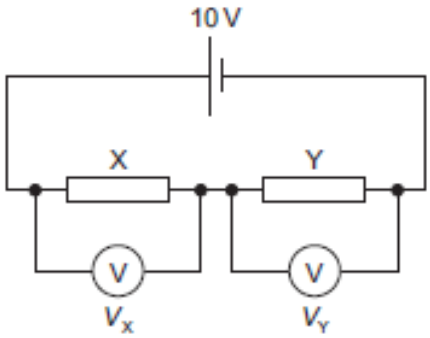
Q-59: A student uses 100 cm of resistance wire XY in a circuit to make a potential divider.



He changes the length of wire *l* by moving the sliding contact along the resistance wire. Which graph shows how the voltmeter reading changes as the length of wire *l* is increased from zero to 100 cm?



Q-60: In the circuit shown, the resistance of resistor Y is four times greater than the resistance of resistor X.

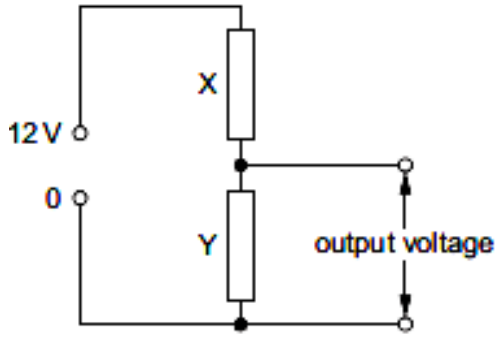


What is the difference $V_Y - V_X$ of the voltages shown on the voltmeters?

A 2.0 V **B** 5.0 V **C** 6.0 V **D** 8.0 V

Q-61: A potential divider uses a power supply of voltage 12 V. The resistors X and Y initially

have equal resistances.



The resistance of X is halved. What is the change in the output voltage?

A –3.0 V **B** –2.0 V **C** +2.0 V **D** +3.0 V

Q-62: A hotplate on an electric cooker contains two identical resistors.
The switch has three positions.
position 1 The two resistors are connected in series to the mains supply.
position 2 The two resistors are connected in parallel to the mains supply.
position 3 Just one resistor is connected to the mains supply.
Which positions correspond to the low, the medium and the high power settings?

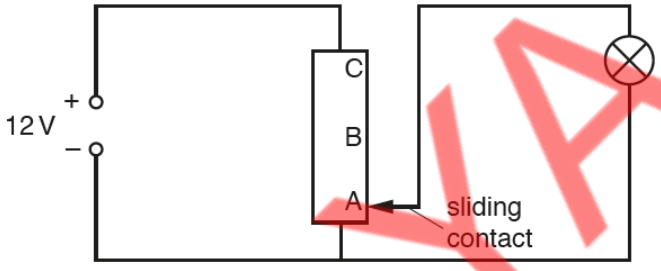
	low power	medium power	high power
A	1	2	3
B	1	3	2
C	3	1	2
D	3	2	1

Q-63: a) A teacher demonstrates the action of a device. Fig. 1 shows the symbol for the

device.

State the name of this device.

b) Fig. 2 shows another device being used in a circuit. The circuit contains a 6.0 V lamp.

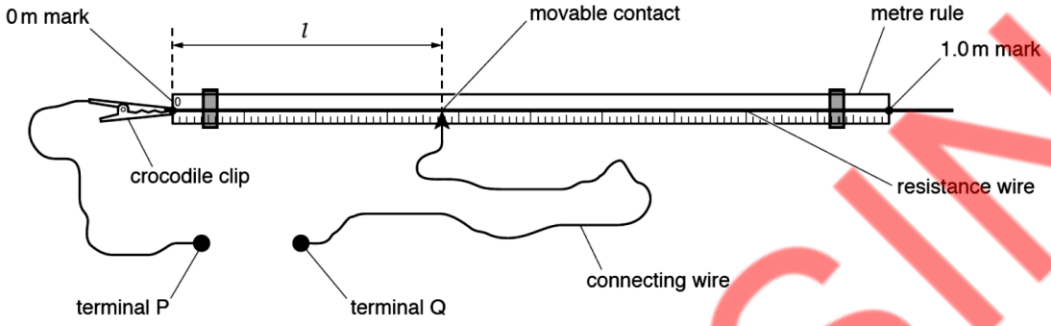


i) The sliding contact of this device is at position A, as shown in Fig. 2. Describe and explain the brightness of the lamp when the sliding contact is in this position.

ii) The teacher moves the sliding contact from position A to position B. Describe and explain what happens to the brightness of the lamp.

iii) The teacher moves the sliding contact from position B to position C. Suggest what happens to the lamp.

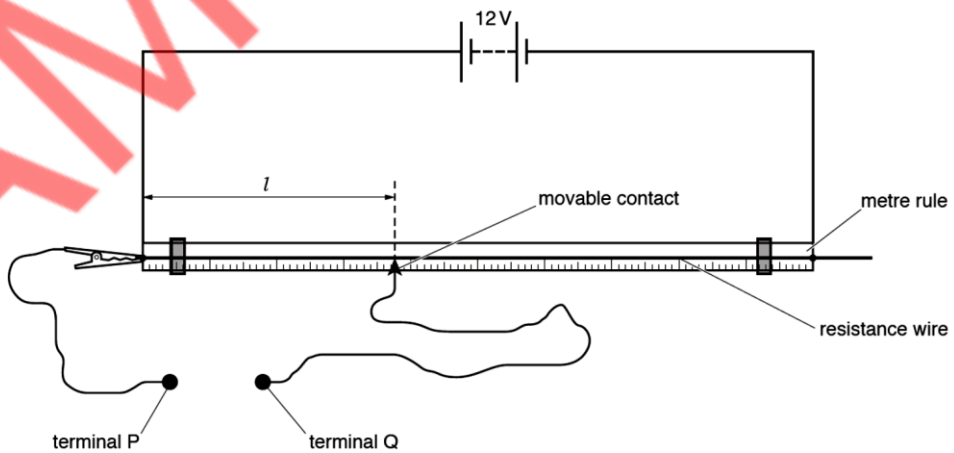
Q-64: The resistance of a 1.0 m length of resistance wire is 7.6 Ω. A length of this wire is taped to a metre rule. A crocodile clip is connected to one end of the resistance wire exactly at the 0 m mark of the rule. Fig. 7.1 shows the crocodile clip connected to terminal P.



A second terminal Q is connected to a movable contact using a long length of connecting wire. The movable contact is in contact with the resistance wire at a length *l* from the 0 m mark on the rule. The movable contact is placed at different points on the resistance wire. The resistance *R* of the length *l* of the wire depends on *l*.

a) On Fig. 7.2, sketch a graph to show how *R* varies with *l* for values of *l* between *l* = 0 and *l* = 1.0 m. Mark appropriate values on the axes of the graph.

b) Fig. 3 shows a battery of electromotive force (e.m.f.) 12 V connected across the 1.0 m length of the resistance wire.



i) State what is meant by *electromotive force* (*e.m.f.*).

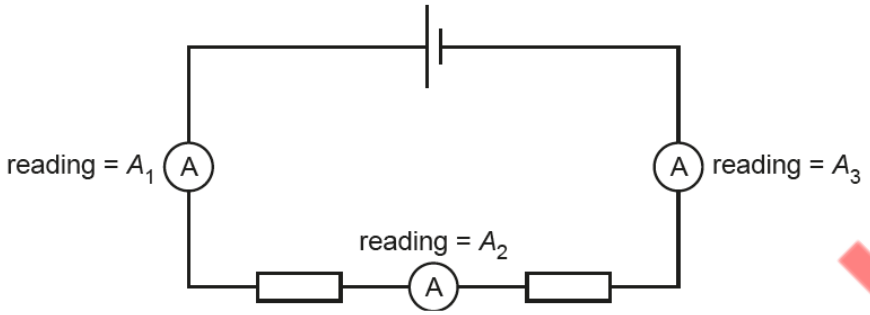
ii) Calculate:

1. the current in the resistance wire

2. the potential difference (p.d.) between terminal P and terminal Q when $l = 0.35$ m

3. the charge that passes through the resistance wire in 5.5 minutes.

Q-65: a) Fig. 1 shows two resistors connected in series with a cell and three ammeters.



i) State the physical quantity that an ammeter measures.

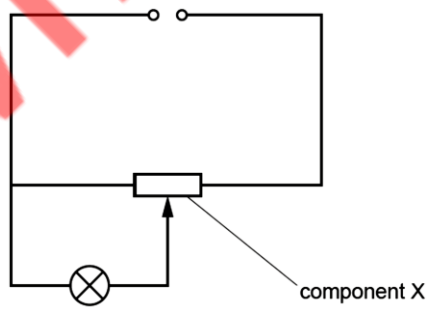
ii) Indicate the correct statement about the readings *A*1, *A*2 and *A*3 on the ammeters in Fig. 1. Tick **one** box.

A_2 is greater than A_1	
A_2 is less than A_3	
A_1 is equal to A_3	
A_1 is equal to $(A_2 + A_3)$	

b) i) Draw a circuit diagram for a battery connected to two resistors in parallel.

ii) State **one** advantage of connecting lamps in parallel.

c) Fig. 2 shows another circuit.



The circuit consists of a power supply, a lamp and component X.

i) Name component X in Fig. 2.

ii) Suggest **one** use of the circuit.

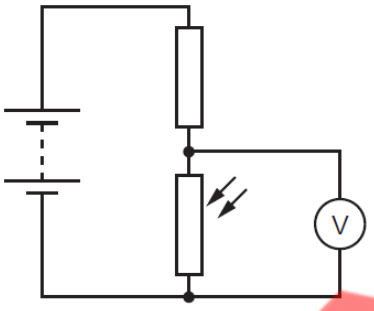
iii) Describe how to use component X and explain its effect on the circuit.

Thermistor/Light Dependent Resistor

Q-66: What happens to the resistance of an LDR when the brightness of light falling on it increases?

A Its resistance decreases.
B Its resistance increases.
C Its resistance increases then decreases.
D Its resistance stays the same.

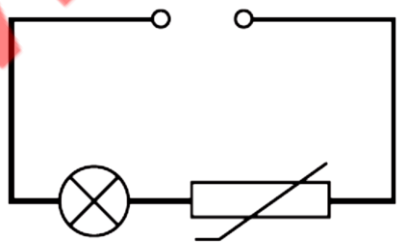
Q-67: The circuit diagram shows a light-dependent resistor (LDR) in a potential divider. A voltmeter is connected across the LDR.



Which row shows the resistance of the LDR and the potential difference (p.d.) shown on the voltmeter at a specific light level?

	light level	resistance of LDR	p.d. shown on the voltmeter
A	bright	low	high
B	bright	high	low
C	dim	high	high
D	dim	low	low

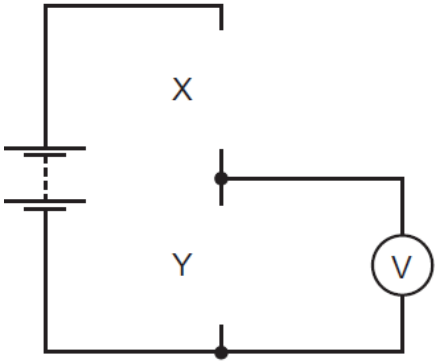
Q-68: The diagram shows a control circuit. The lamp is lit.



The temperature of the surroundings increases. What will happen to the brightness of the lamp?

A It will be brighter.
B It will be less bright.
C It will not change.
D It will become brighter and then less bright.

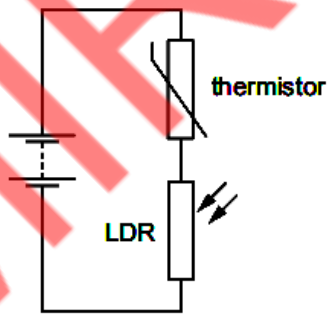
Q-69: The circuit below can be completed by inserting components at X and at Y. The completed circuit is a potential divider in which the potential difference across component Y increases when the temperature increases.



Which row shows the components X and Y?

	X	Y
A	light-dependent resistor	resistor
B	resistor	light-dependent resistor
C	resistor	thermistor
D	thermistor	resistor

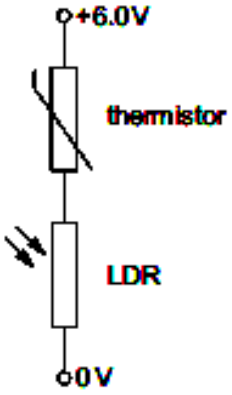
Q-70: In the circuit shown, the temperature of the room and the amount of light affect the current



Under which conditions is the current in the circuit the largest?

	temperature	amount of light
A	high	in bright light
B	high	in the dark
C	low	in bright light
D	low	in the dark

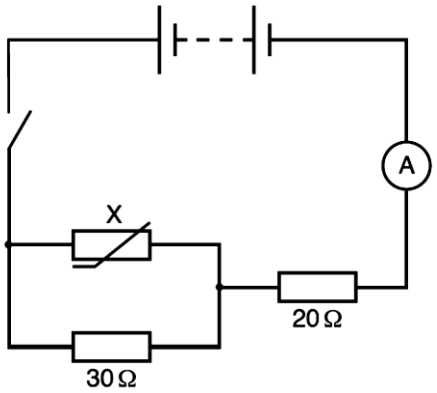
Q-71: A thermistor and a light-dependent resistor (LDR) are connected in series. A potential difference (p.d.) of 6.0 V is applied across them as shown.



The thermistor has a resistance of 6000 Ωin a cold room and 1000 Ωin a warm room. The LDR has a resistance of 2000 Ωin dim light and 500 Ωin bright light. When is the p.d. across the LDR equal to 2.0 V?

A in a cold room with bright light
B in a cold room with dim light
C in a warm room with bright light
D in a warm room with dim light

Q-72: Fig. 1 shows a circuit diagram that includes component X.



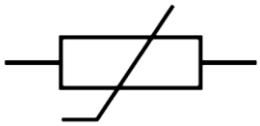
a) State the name of component X.

b) The electromotive force (e.m.f.) of the battery is *E*. The switch is closed.
The potential difference (p.d.) across the 30 Ω resistor is *V*30.
The p.d. across the 20 Ω resistor is *V*20.
The p.d. across component X is *V*X.
State an equation that relates *V*X to:

i) *V*30

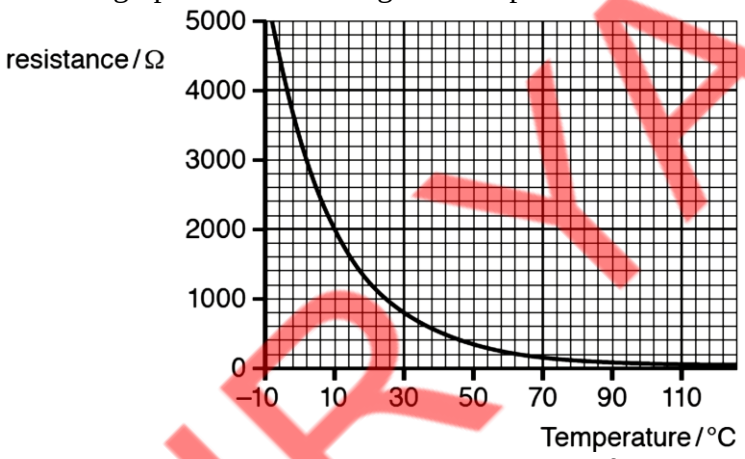
ii) *E* and *V*20.

Q-73: Fig. 1 shows the symbol for an electrical component.



a) State the name of the component shown in Fig. 1.

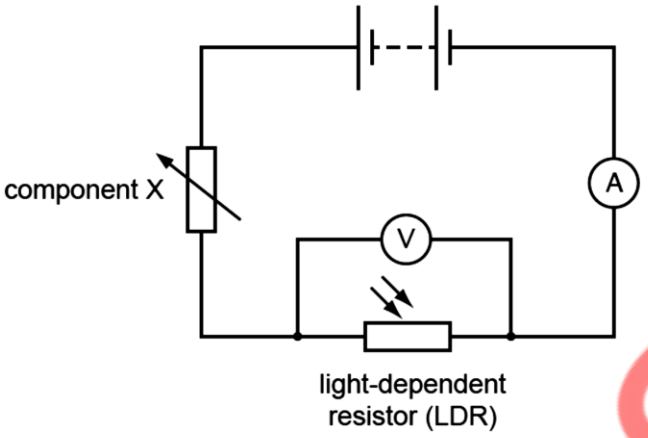
b) The resistance of the component shown in Fig. 1 varies with temperature. Fig. 2 shows a graph of resistance against temperature for the component.



i) Use Fig. 2 to determine the resistance of the component at a temperature of 10 °C.

ii) At another temperature, the resistance of the component is 800 Ω. Calculate the current in the component when it is connected to a 12.0 V supply.

Q-74: a) Fig. 1 shows an electric circuit.



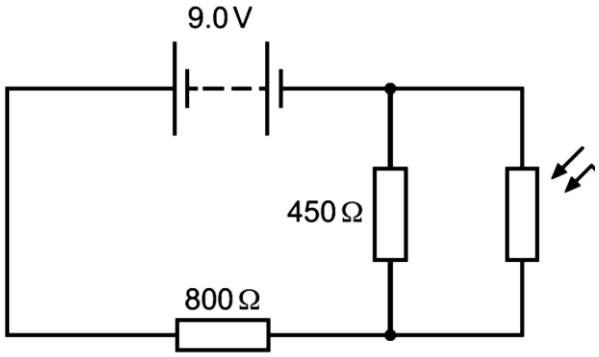
i) The current in the metal wires of the circuit is a flow of particles.
State the name of these particles.

ii) State the name of component X.

iii) The circuit is in a darkened room. The voltmeter reading is 5.5 V and the ammeter reading is 0.050 A. Calculate the resistance of the light-dependent resistor (LDR).

b) The light in the room is switched on. The room becomes bright.
State and explain how increasing the brightness of the light that falls on the LDR changes the current in the circuit.

Q-75: A circuit contains two fixed resistors and a light-dependent resistor (LDR). Fig. 1 shows that the power supply is a 9.0 V battery.



The current in the 450 Ω resistor is 0.012 A.

a) State what is meant by electric current.

b) The current in the LDR is $I1$ and the current in the 800 Ω resistor is $I2$.
Complete the equation that relates the current in the 450 Ω resistor to $I1$ and $I2$.

c) Calculate the power dissipated in the 800 Ω resistor.

d) The brightness of the light that is incident on the LDR increases.
Explain what happens to the potential difference (p.d.) across the 450 Ω resistor.

Answers

Q-1: D **Q-2: B** **Q-3: A** **Q-4: D** **Q-5: B** **Q-6: A** **Q-7:B**

Q-8: C **Q-9: B** **Q-10: C** **Q-11: D**

Q-12: a) ammeter symbol
ammeter in series (with power supply)
voltmeter symbol
voltmeter in parallel (with lamps/power supply)
two lamps in parallel

b) (brightness) stays the same
current (in working lamp) stays the same

Q-13: B **Q-14: B** **Q-15: D** **Q-16: C** **Q-17: B** **Q-18: A** **Q-19: B**

Q-20: B **Q-21: A** **Q-22: B** **Q-23: B** **Q-24: B** **Q-25: C** **Q-26: D**

Q-27: B **Q-28: C** **Q-29: B** **Q-30: B** **Q-31: B** **Q-32: A** **Q-33: A**

Q-34: D **Q-35: D** **Q-36: C** **Q-37: C** **Q-38: B** **Q-39: B** **Q-40: D**

Q-41: D **Q-42: A** **Q-43: C**

Q-44: a) i) cell symbol correctly drawn
ii) series
iii) electrons

b) i) any two from:
(both) lamps have correct / full potential difference
if one lamp fails the other lamp still lights
lamps can be switched (on/off)independently

ii) V = IR or (I =) V ÷ R
3 ÷ 12
0.25 (A)

Q-45: a) (I=)V / R algebraic or numerical
0.4(0) A

b) current in Q is 0.25 (A)
or (total resistance) 6 / 0.25 or 6 / 0.65 or 9.2(3 Ω) seen
24 Ω

c) i) correct circuit with two lamps ammeter and battery in series
ii) (total) resistance increases
or (each) lamp has lower p.d. across it

Q-46: a) $1 / R_t = 1 / R_1 + 1 / R_2$ or $R_t = R_1R_2 / (R_1 + R_2)$ formulae or numbers using 20 and 40 Ω or 13(.3 Ω)
$R_t = R_1 + R_2$ or 20 + any attempt at parallel calculation
33(.3) Ω

b) $V_2 = V_3$
V_1 largest or larger than either V_2 or V_3

Q-47: a) i) the same as
ii) larger than
iii) the same as
iv) smaller than

b) same brightness / if one fails the rest are still lit / lamps can be switched off independently / same p.d. across owtte

c) V = I × R in any form (R =) V ÷ I
12 ÷ 0.048
250
Ω / ohms

Q-48: a) i) (I=) V / R or 6/60
0.1(0) A
ii) (I=) P / V or 0.9 / 6
or 0.15 (A) seen
0.25 A

b) i) lamp correctly drawn in series with resistor but not the lamp
ii) less voltage (across lamp) because some voltage across resistor / shares voltage with resistor or less current because of effect of resistor

Q-49: a) i) $1 / R_T = 1 / R_1 + 1 / R_2$ or $1 / R_T = 1 / 3.6 + 1 / 1.8$ or $(R_T =) R_1 R_2 / (R_1 + R_2)$ or
1.8 × 3.6 / (1.8 + 3.6)
1.2 (Ω)
4.0 Ω
ii) (I =) V / R or 6.0 / 4.0
1.5 (A)

b) i) work done / energy (released) per unit charge (passed through component)
ii) voltmeter symbol and across 2.8 Ω resistor
iii) total resistance increases or resistance of circuit / parallel

Q-50: a) parallel
b) i) correct voltmeter symbol drawn across power supply
ii) X marked in series with resistor A
c) i) 1.5 V cao
ii) 0.1(0) A ecf (c)(i) ÷ 15
d) circuit 2 PLUS
two series resistors in parallel loop / no resistor in series with power supply
owtte / resistance is 6⅔ Ω

Q-51: A Q-52: A Q-53: D Q-54: B Q-55: B Q-56: B Q-57: B

Q-58: D Q-59: A Q-60: C Q-61: C Q-62: B

Q-63: a) thermistor
b) i) low (brightness) OR off
pd or voltage (across lamp) is zero or almost zero
ii) (brightness / it) increases

p.d. / voltage (across lamp) increases
iii) lamp blows / fuses (when p.d. too high)

Q-64: a) 7 / 7.6 / 8 / 10 marked towards top of *y*-axis and 1(.0) towards right of *x*-axis
a straight line of positive gradient from 0, 0 to point 1.0, 7.6

b) i) energy (transferred) per unit charge
energy (transferred) from chemical or energy (transferred) to electrical or energy (transferred) around / in a (complete) circuit

ii) 1. $I = V / R$ or in any form words, symbols or numbers or (I =) V / R or 12 / 7.6
1.6 A
2. 4.2 V or 4.3 V
3. $Q = It$ or in any form words, symbols or numbers or (Q =) It
5.5 or 8.8 (C)
520 C or 530 C

Q-65: a) i) (electric) current
ii) tick in third box A1 is equal to A3

b) i) resistors in parallel
connected to battery AND correct circuit symbol for battery
ii) same brightness / if one fails the rest are still lit / lamps can be switched off independently / same p.d. across owtte

c) i) potential divider / potentiometer
ii) dimmer / change light output / intensity
iii) move the slider
varies p.d. (across lamp)

Q-66: C Q-67: C Q-68: A Q-69: D Q-70: A Q-71: C

Q-72: a) thermistor

b) i) $VX = V30$
ii) $VX = E - V20$ in any form

c) i) $1/R1 + 1/R2 = 1/R\text{tot}$ OR (Rtot =) $R1\ R2 / (R1 + R2)$
OR $1/15 + 1/30 = 1/R\text{tot}$
OR $(15 \times 30) / (15 + 30)$
OR $10 + 20$
30 Ω
ii) $I = V / R$ in any form OR (I =) V / R OR 6.0 / 30
0.20 A

d) resistance of X decreases
ammeter reading / it increases and (total) resistance (of circuit) decreases / more voltage across 20 Ω resistor

Q-73: a) thermistor

b) i) 2000 (Ω)
ii) (I =) V ÷ R OR V = I × R in any form
12 ÷ 800
0.015 (A)

Q-74: **a)** **i)** **electron(s)**

ii) **(component X is a) variable resistor**

iii) **V= IR or (R =) V/I**

5.5 ÷ 0.05 (0)

110 (Ω)

b) **(current in circuit) increases**

(because) resistance of LDR decreases

Q-75: **a)** ***Q* / *t* or (rate of) flow of (electric) charge / electrons**

b) **(current in the 450 Ω resistor =)**

c) **(*V*450 Ω =) *IR* or 0.012 × 450 or 5.4 (V) or 9.0 – 5.4 or 3.6 (V) seen**

(*I* =) 3.6 / 800 or 0.0045 (A) C1

(*P* =) *VI* or 3.6 × 0.0045 or 3.62 / 800 1.6 × 10^{-2} W or 16 mW

d)

resistance (of LDR) decreases		
current (in circuit) increases	**or**	resistance of parallel pair decreases
p.d. across 800 Ω resistor increases **and** p.d. across 450 Ω resistor decreases	**or**	resistance of parallel pair a smaller fraction of total resistance **and** p.d. across 450 Ω resistor decreases