O Level Combined Physics Structured

Current and DC Circuits Test 3.0

Q1

Fig. 8.1 shows a circuit in which all the switches are opened.

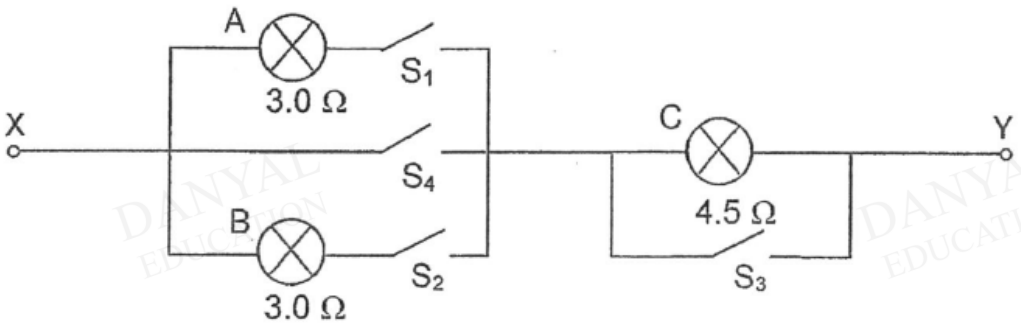


Fig. 8.1

(a) Calculate the effective resistance between X and Y when S_1 and S_2 are closed.

effective resistance = _____ Ω [2]

(b) Suggest which light bulb(s) will light up when all switches are closed. Explain your answer.

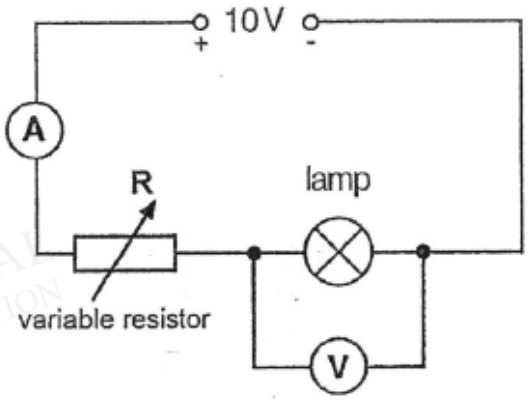
_____

_____

_____ [2]

Q2

The battery in the circuit below has an e.m.f. of 10 V and negligible resistance. The variable resistor **R** is adjusted until the voltmeter reading is 2.5 V and the ammeter reading is 0.5 A.



(a) Determine the resistance of the light bulb.

resistance = ... [2]

(b) Calculate the resistance of the variable resistor **R**.

resistance = ... [2]

(c) The resistance of the variable resistor **R** is now increased to 45 Ω.

Assuming that the resistance of the light bulb in **(a)** remains unchanged, state and explain what happens to the brightness of the light bulb.

.....

.....

..... [2]

Q3

Three resistors are arranged in parallel as shown in the circuit in Fig. 10.1.

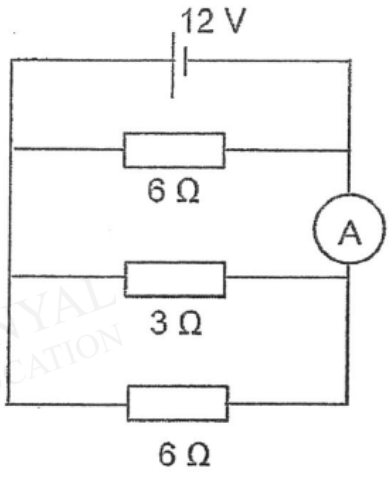


Fig 10.1

a) What is the total resistance of the circuit?

total resistance = ... Ω [2]

b) What is the total circuit current?

total current = ... A [2]

c) What is the reading in the ammeter?

ammeter reading = ... A [1]

Q4

The circuit in Fig. 8 was completed with 1 e.m.f. source, E and 3 resistors placed as shown. Potential difference across X and Y is 18 V.

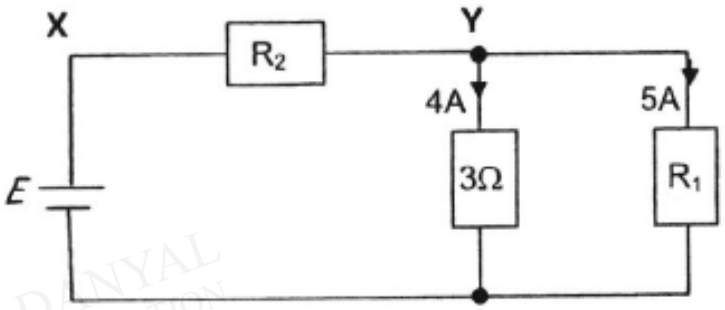


Fig. 8

(a) What is the resistance, R_1 ? [2]

(b) What is the resistance R_2? [2]

(c) What is the e.m.f., E? [2]

Q5

Fig. 7.1 shows an electrical circuit containing four resistors R_1, R_2, R_3 and R_4 connected to a 12 V cell.

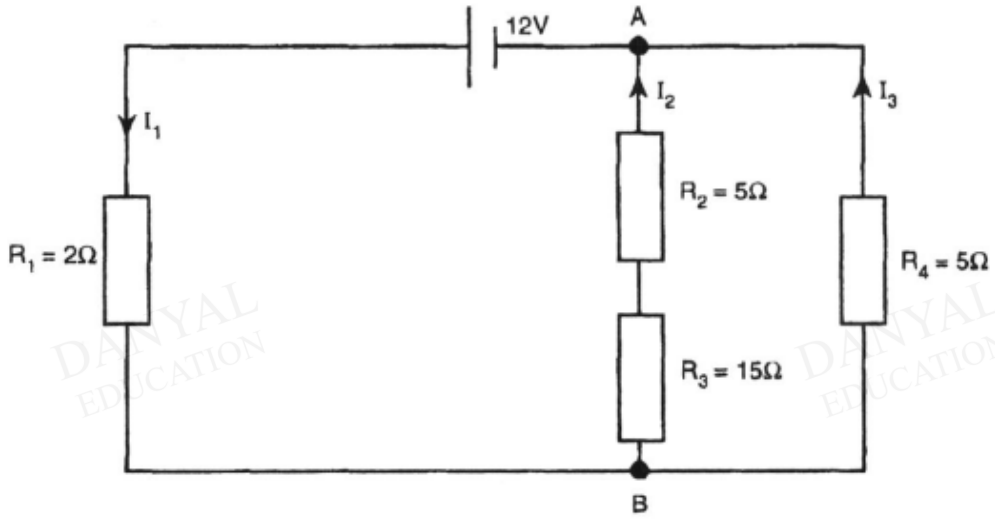


Fig. 7.1

Calculate

(a) the effective resistance of the circuit,

effective resistance = ... [2]

(b) the potential difference across R_1, R_2 and R_4,

p.d. across R_1 = ...

p.d. across R_2 = ...

p.d. across R_4 = ... [3]

Answers

Current and DC Circuits Test 2.0

Q1

(a)	Effective resistance = $(1/3 + 1/3)^{-1} + 4.5$ = 6.0 Ω	[1] [1]
(b)	When all switches are closed, the light bulbs will not light up as there is a short circuit.	[1] [1]

Q2

(a)	R = V/I = 2.5/0.5 = 5 Ω	1 1
(b)	P.d. across variable resistor = 7.5 V R = V/I = 7.5/0.5 = 15 Ω	1 1
(c)	The potential difference of the lamp will decrease / current decrease This leads to a decrease in the brightness of the lamp.	1 1

Q3

)a	Total R = $(1/3 + 1/6 + 1/6)^{-1}$ = 1.5 Ω	M1 A1
)b	Total current = V / R = 12/1.5 = 8 A Can also use ohm's law to find individual branch current and sum up.	M1 A1
)c	Reading = 4 A + 2 A = 6 A	A1

Q4

The circuit in Fig. 8 was completed with 1 e.m.f. source, E and 3 resistors placed as shown. Potential difference across X and Y is 18 V.

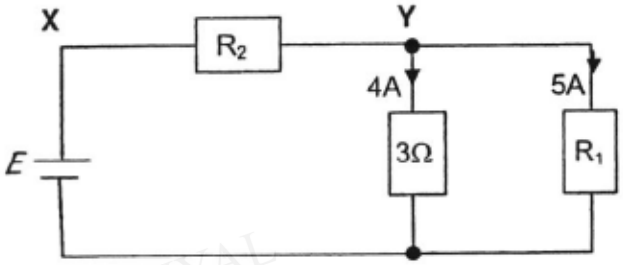


Fig. 8

(a) What is the resistance, R_1 ? [2]

Pd across 3Ω = pd across R_1 [1]$_1$

4 x 3 = 5 x R_1

R_1 = 12/ 5 = 2.4 Ω [1]

(b) What is the resistance R_2? [2]

Total current flowing through R_2 = 9 A

R_2 = 18 / 9 = 2 Ω [1]

(c) What is the e.m.f., E? [2]

Emf = pd across XY + pd across 3Ω

= 18 V + 3 (4) [1]

= 30 V [1]

Q5

(a) the effective resistance of the circuit,

$$\frac{1}{R_s} = \frac{1}{20} + \frac{1}{5}$$

$$= \frac{5}{20}$$

$$R_s = 4\,\Omega \quad [1]$$

$R_T = 2 + 4 = 6\ \Omega$ [1]

effective resistance = ... [2]

(b) the potential difference across R_1, R_2 and R_4,

$$I_1 = \frac{V_T}{R_T}$$

$$= \frac{12}{6}$$

$$= 2.0\ A \quad [1]$$

Hence p.d. across R_1 = 2 A x 2 Ω = 4 V [1]
I_2 = 5/25 x I_1 = 0.4 A, hence p.d. across R_2 = 0.4 A x 5 Ω = 2 V [1]
I_3 = 20/25 x I_1 = 1.6 A, hence p.d. across R_4 = 1.6 A x 5 Ω = 8 V [1]