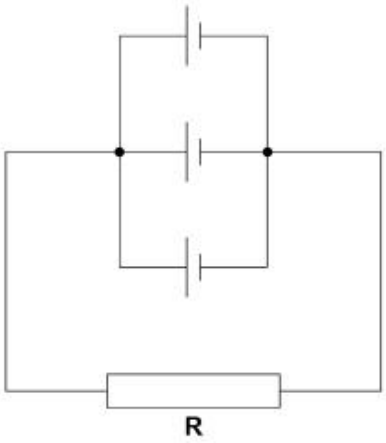
Q1.

Three identical cells, each of emf 1.5 V and internal resistance 6.0 Ω, are connected to resistor **R**. The resistance of **R** is 6.0 Ω.



What is the current in **R**?

A 0.19 A ⬭

B 0.25 A ⬭

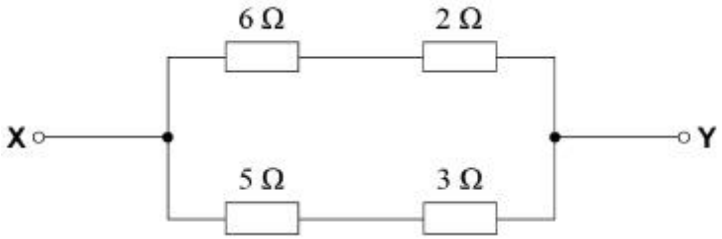
C 0.56 A ⬭

D 0.75 A ⬭

(Total 1 mark)

Q2.

In the circuit shown, a potential difference of 3.0 V is applied across **XY**.



What is the current in the 5 Ω resistor?

A 0.38 A

B 0.60 A

C 0.75 A

D 2.7 A

(Total 1 mark)

Q3.

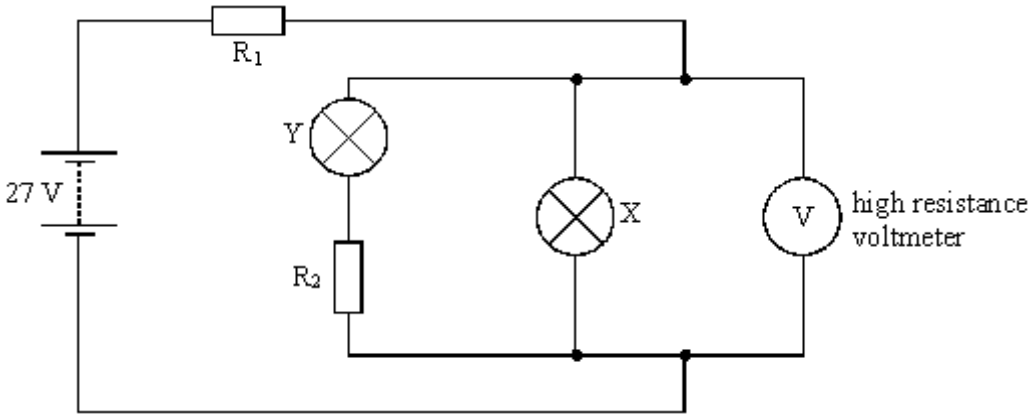
(a) X and Y are two lamps. X is rated at 12 V, 24 W and Y at 6.0 V, 18 W. Calculate the current through each lamp when it operates at its rated voltage.

X: _____

Y: _____

(2)

(b) The two lamps are connected in the circuit shown. The battery has an emf of 27 V and negligible internal resistance. The resistors R_1 and R_2 are chosen so that the lamps are operating at their rated voltage.



(i) What is the reading on the voltmeter?

_____

(ii) Calculate the resistance of R_2.

_____

_____

_____

(iii) Calculate the current through R_1.

_____

(iv) Calculate the voltage across R_1.

_____

(v) Calculate the resistance of R_1.

_____

(7)

(Total 9 marks)

Q4.

(a) In the circuit in **Figure 1**, the battery, of emf 15 V and the negligible internal resistance, is connected in series with two lamps and a resistor. The three components each have a resistance of 12 Ω.

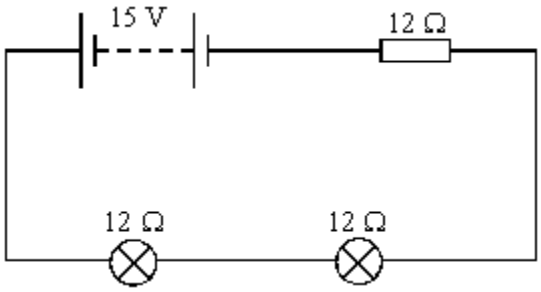


Figure 1

(i) What is the voltage across each lamp?

_____

(ii) Calculate the current through the lamps.

_____

_____

(3)

(b) The two lamps are now disconnected and reconnected in parallel as shown in **Figure 2**.

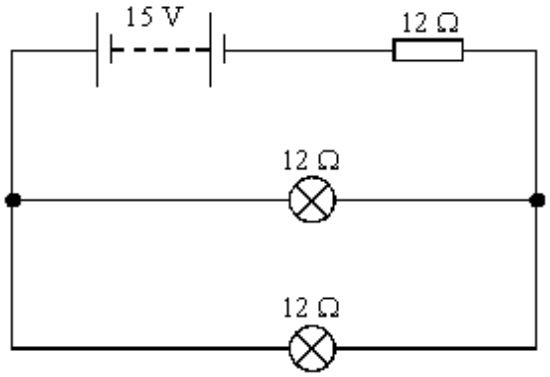


Figure 2

(i) Show that the current supplied by the battery is 0.83 A.

_____

_____

_____

_____

(ii) Hence show that the current in each lamp is the same as the current in the lamps in the circuit in **Figure 1**.

_____

_____

_____

_____

(3)

(c) How does the brightness of the lamps in the circuit in **Figure 1** compare with the brightness of the lamps in the circuit in **Figure 2**?

Explain your answer.

_____

_____

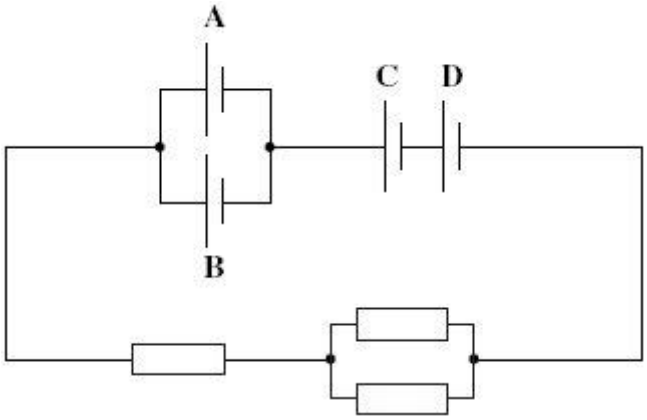
_____

(2)

(Total 8 marks)

Q5.

The circuit in the diagram below contains four identical new cells, **A**, **B**, **C** and **D**, each of emf 1.5V and negligible internal resistance.



(a) The resistance of each resistor is 4.0 Ω.

(i) Calculate the total resistance of the circuit.

answer = _____ Ω

(1)

(ii) Calculate the total emf of the combination of cells.

answer = _____ V

(1)

(iii) Calculate the current passing through cell **A**.

answer = _____ A

(2)

(iv) Calculate the charge passing through cell **A** in five minutes, stating an appropriate unit.

answer = _____

(2)

(b) Each of the cells can provide the same amount of electrical energy before going flat.
State and explain which two cells in this circuit you would expect to go flat first.

_____

_____

_____

_____

_____

_____

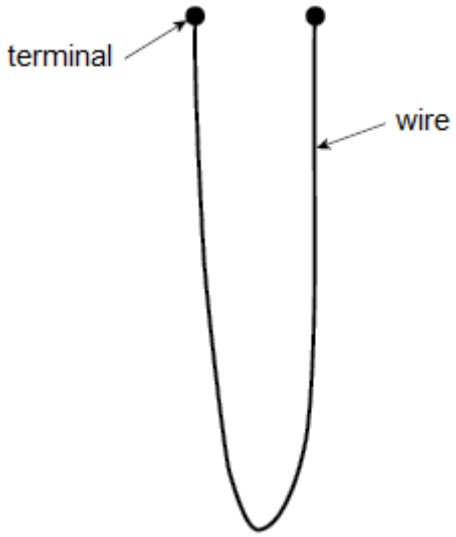
(3)

(Total 9 marks)

Q6.

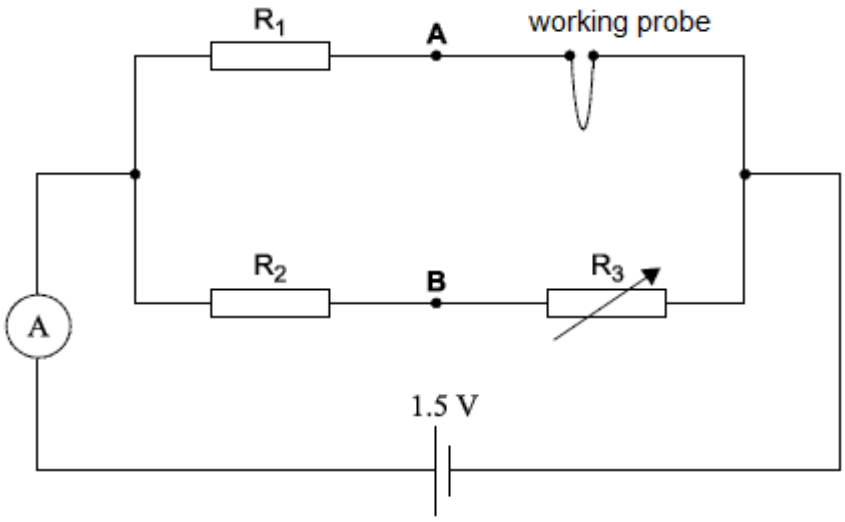
A wire probe is used to measure the rate of corrosion in a pipe carrying a corrosive liquid. The probe is made from the same metal as the pipe. **Figure 1** shows the probe. The rate of corrosion of the wire in the probe is the same as in the pipe.

Figure 1



(b) In order to measure the resistance of a used working probe, it is connected in the circuit shown in **Figure 2**.

Figure 2



When R_3 is adjusted to a particular value the current in the cell is 0.66 A.

Calculate the total resistance of the circuit.
You may assume that the cell has a negligible internal resistance.

resistance = _____ Ω

(1)

(c) The resistance of R_2 is 22 Ω and the resistance of R_3 is 1.2 Ω.

Calculate the current in R_3.

current = _____ A

(1)

(d) Calculate the resistance of the probe when the resistance of R_1 is 2.4 Ω.

resistance = _____ Ω

(3)

(f) A voltmeter is connected between points **A** and **B** in the circuit and R_3 stays at 1.2 Ω.

Explain, without calculation, why the reading on the voltmeter does not change when the cell in the circuit is replaced with another cell of the same emf but a significant internal resistance.

_____

_____

_____

_____

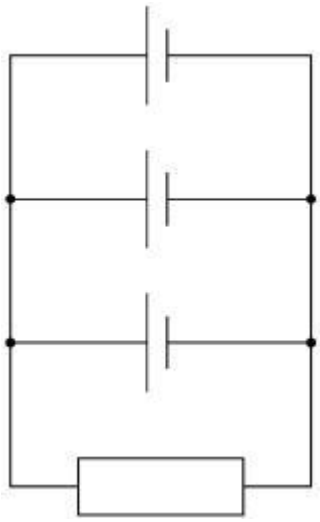
_____

(2)

(Total 7 marks)

Q7.

A resistor of resistance R and three identical cells of emf E and internal resistance r are connected as shown.



What is the current in the resistor?

A $\frac{3E}{(3R+r)}$ ⬭

B $\frac{9E}{(3R+r)}$ ⬭

C $\frac{E}{R}$ ⬭

D $\frac{3E}{R}$ ⬭

(Total 1 mark)