# Electrical Energy & Power

**Name & Set**

1 For safe operation, what is the maximum pd. that can be applied across a

(a) 0.5 Ω, 22 W resistor

_____

_____ [2]

(b) 100 Ω, 22 W resistor?

_____

_____ [2]

2 A lighting circuit in a house has a 5 amp fuse. If the supply voltage is 240V, calculate how many 60 Watt lamps can be safely run from this circuit at the same time.

_____

_____ [2]

3 P & Q represent two identical elements in an electric oven. Each element has a working resistance of 60 Ω. By means of a suitable switch they may be connected in three different ways shown in the diagrams below. The p.d. between A & B is 240 Volts.

(a) Calculate the resistance of each combination.

_____

_____ [2]

(b) Which circuit takes the least current? Calculate this current.

_____

_____ [2]

(c) Which circuit takes the maximum current? Calculate this current.

_____

_____ [2]

(d) What is the minimum power consumption of the oven?

_____

_____ [2]

(e) What is the maximum power consumption of the oven?

_____

_____ [2]

(f) If the p.d. across AB were to fall from 240V to 220V, what would then be the maximum power consumption?

_____

_____ [2]

4 Two physics students, Andy and Bill, living in neighbouring rooms decide to economise by connecting their ceiling lights in series (to a dc. supply.) They agree that they will each install a 100 W bulb in his own room and that they will pay equal shares of the electricity bill. However, both decided to get better lighting at the expense of the other: A installed a 200 W lamp and B installed a 50 W lamp. Which student subsequently failed to pass his exam in electricity?

_____

_____

_____

_____

_____ [4]

5 (a) Calculate the power developed in a heating element of resistance 60 Ω when it is run from a 240 V supply.

_____

_____ [2]

(b) If two such heating elements are available what is the best way to connect them across the 240 V supply in order to obtain the *maximum* rate of energy conversion: series or parallel? A calculation is expected.

_____

_____

_____

_____ [2]

6 A heating coil is to be made that will operate on a 12 V supply and have a power of 36 W when immersed in water. The wire available has an area of cross-section of 0.10 $mm^2$ and is made of nichrome. What length of wire will be required? Resistivity of nichrome = $1.08 \times 10^6$ Ωm

_____

_____

_____

_____ [3]

7 (a) Calculate the resistance of a filament lamp rated at 240 V 60 W.

_____

_____

_____ [2]

(b) Calculate the current that flows through the filament when it is working.

_____

_____

_____ [2]

(c) What is the minimum number of torch batteries each of e.m.f. 1.5 V and internal resistance 0.6 Ω needed to make this bulb light.

_____

_____

_____ [2]

8 Two dissimilar bulbs A & B are connected in parallel across a 3V battery. Bulb A is rated at 3V, 0.6A and bulb B is rated at 2V, 0.5A. In order to ensure that B is run at its correct rating, a resistor is placed in series with it.

(a) Draw a circuit diagram.

_____

_____

_____ [2]

(b) Calculate the value of the resistor.

_____

_____

_____ [2]

9 A hairdrier for use by travellers is designed to operate at dual voltage 110V/220V. The drier produces 1100 W at either voltage by passing a current through two identical coils (i.e.of equal resistance.)

(a) Calculate the total resistance of the coils at each voltage.

_____

_____

_____ [3]

(b) What is the resistance of each coil and should they be connected to (i) the 110 V mains and (ii) the 220 V mains to produce the same power in both cases.

_____

_____

_____ [3]

10 (a) Two identical bulbs A & B are in series with a battery as shown in figure 1.

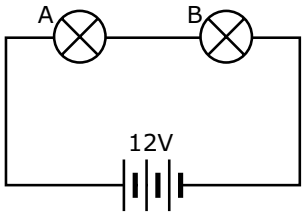



fig. 1

Each lamp is rated at 6V, 4W. Calculate

(i) the current drawn from the battery,

_____ [1]

(ii) the working resistance of each bulb.

_____

_____ [2]

(b) A resistor, R, of 9 Ohms is now placed in parallel with Bas shown in figure 2. Assuming that the working resistances of both lamps remain the same as in figure 1

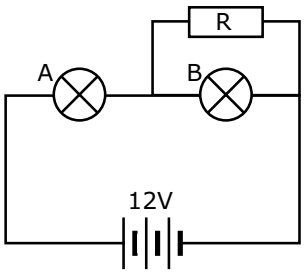



fig. 2

(i) What is the p.d. across A and across B?

_____

_____

_____ [3]

(ii) What current now flows through B and through A?

_____

_____

_____ [3]

(iii) What is the power dissipated in A and in B?

_____

_____

_____ [3]

(iv) How does the brightness of A & B compare to their brightness in the circuit in diagram 1?.

_____

_____ [2]

(c) The resistor is now placed in parallel with A and B as shown in figure 3.

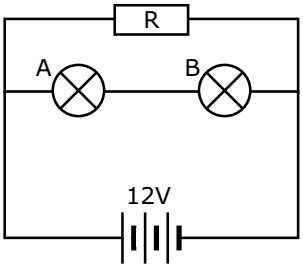



fig. 3

(i) What is the p.d. across A and across B?

_____

_____

_____ [3]

(ii) What current now flows through B and through A?

_____

_____

_____ [3]

(iii) What current is drawn from the battery?

_____

_____

_____ [3]

(vi) What is the power dissipated in A and in B?

_____

_____

_____ [3]

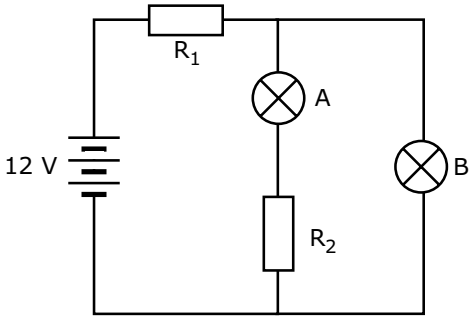
(v) What happens to the brightness of A & B.

_____

_____

_____ [3]

11 The circuit in diagram 4 shows two lamps A and B, rated at 3 V 0.6 W and 6 V 0.3 W respectively. Resistors $R_1$ and $R_2$ are chosen so that both lamps are working at their correct ratings from a 12 V dc. supply.




(a) Calculate the current through each lamp when in normal operation.

(i) Through A _____

_____ [1]

(i) Through B _____

_____ [1]

(b) Calculate the resistance of each lamp.

(i) Resistance of A _____

_____ [1]

(i) Resistance of A _____

_____ [1]

(c) Use the answers to (a) and (b) to calculate the values of $R_1$ & $R_2$.

(i) Resistance $R_1$ _____

_____

_____ [2]

(i) Resistance $R_1$ _____

_____

_____ [2]

(d) What would happen to either lamp if the other one should burn out. Assume that the resistance of the lamps does not change when the other one burns out.

_____

_____

_____

_____

_____

_____ [3]