Name of the Student:_____
Max. Marks : 24 Marks **Time :** 24 **Minutes**

Q1.

A student investigates how the power dissipated in a variable resistor, Y, varies as the resistance is altered.
Figure 1 shows the circuit the student uses. Y is connected to a battery of emf ε and internal resistance r.

Figure 1

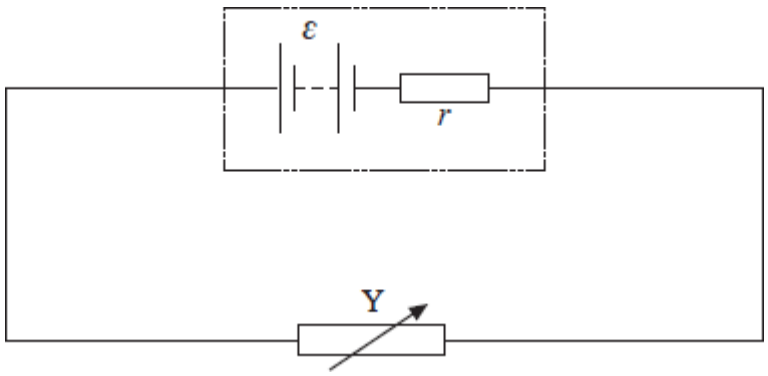
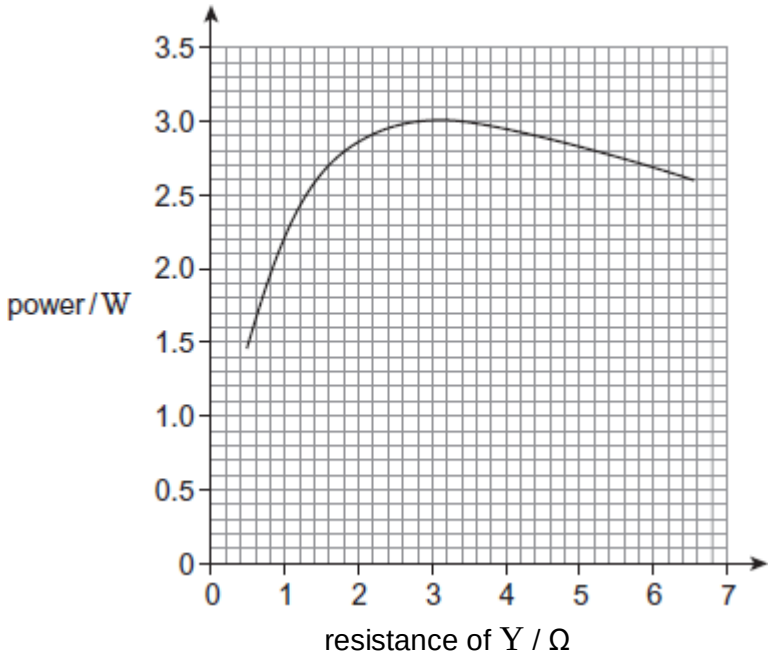


Figure 2 shows the results obtained by the student as the resistance of Y is varied from 0.5 Ω to 6.5 Ω.

Figure 2



(a) Describe how the power dissipated in Y varies as its resistance is increased from 0.5 Ω to 6.5 Ω.

_____

_____

_____

_____

_____

(2)

(b) The emf of the battery is 6.0 V and the resistance of Y is set at 0.80 Ω.

(i) Use data from **Figure 2** to calculate the current through the battery.

current _____ A

(3)

(ii) Calculate the voltage across Y.

voltage _____ V

(2)

(iii) Calculate the internal resistance of the battery.

internal resistance _____ Ω

(2)

(c) The student repeats the experiment with a battery of the same emf but negligible internal resistance. State and explain how you would now expect the power dissipated in Y to vary as the resistance of Y is increased from 0.5 Ω to 6.5 Ω.

_____

_____

_____

_____

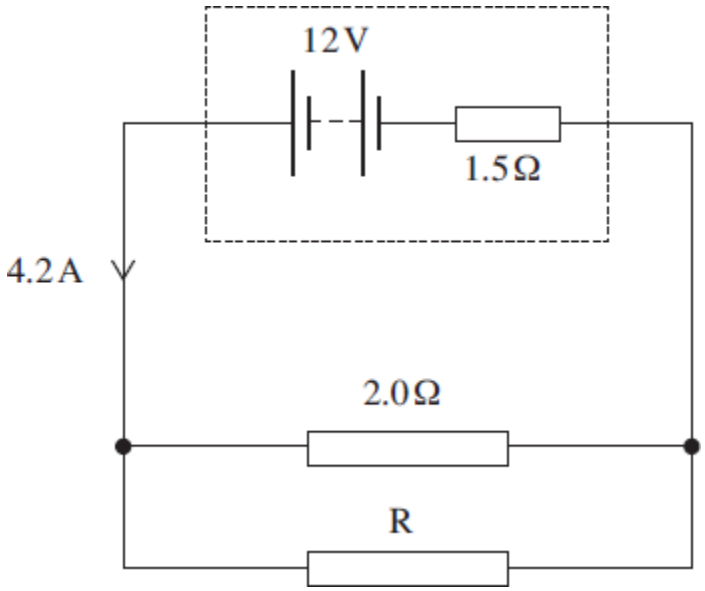
_____

(3)

(Total 12 marks)

Q2.

The circuit diagram below shows a battery of electromotive force (emf) 12 V and internal resistance 1.5 Ω connected to a 2.0 Ω resistor in parallel with an unknown resistor, R. The battery supplies a current of 4.2 A.



(a) (i) Show that the potential difference (pd) across the internal resistance is 6.3 V.

(1)

(ii) Calculate the pd across the 2.0 Ω resistor.

pd _____ V

(1)

(iii) Calculate the current in the 2.0 Ω resistor.

current _____ A

(1)

(iv) Determine the current in R.

current _____ A

(1)

(v) Calculate the resistance of R.

R _____ Ω

(1)

(vi) Calculate the total resistance of the circuit.

circuit resistance _____ Ω

(2)

(b) The battery converts chemical energy into electrical energy that is then dissipated in the internal resistance and the two external resistors.

(i) Using appropriate data values that you have calculated, complete the following table by calculating the rate of energy dissipation in each resistor.

resistor	**rate of energy dissipation / W**
internal resistance	
2.0 Ω	
R	

(3)

(ii) Hence show that energy is conserved in the circuit.

_____

_____

(2)

(Total 12 marks)