3 A battery is connected with resistors *R*, X and Y, as shown in Fig. 3.1.

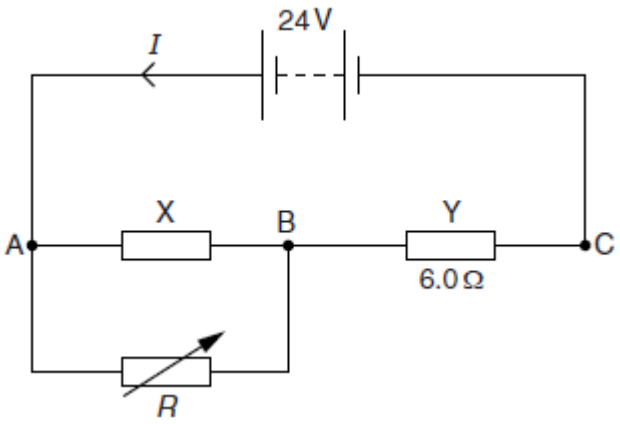

Fig. 3.1

The resistance of X is constant. The resistance of Y is 6.0 Ω. The battery has electromotive force (e.m.f.) 24 V and zero internal resistance. A variable resistor of resistance *R* is connected in parallel with X.

The current I from the battery is changed by varying *R* from 5.0 Ω to 20 Ω. The variation with *R* of I is shown in Fig. 3.2.

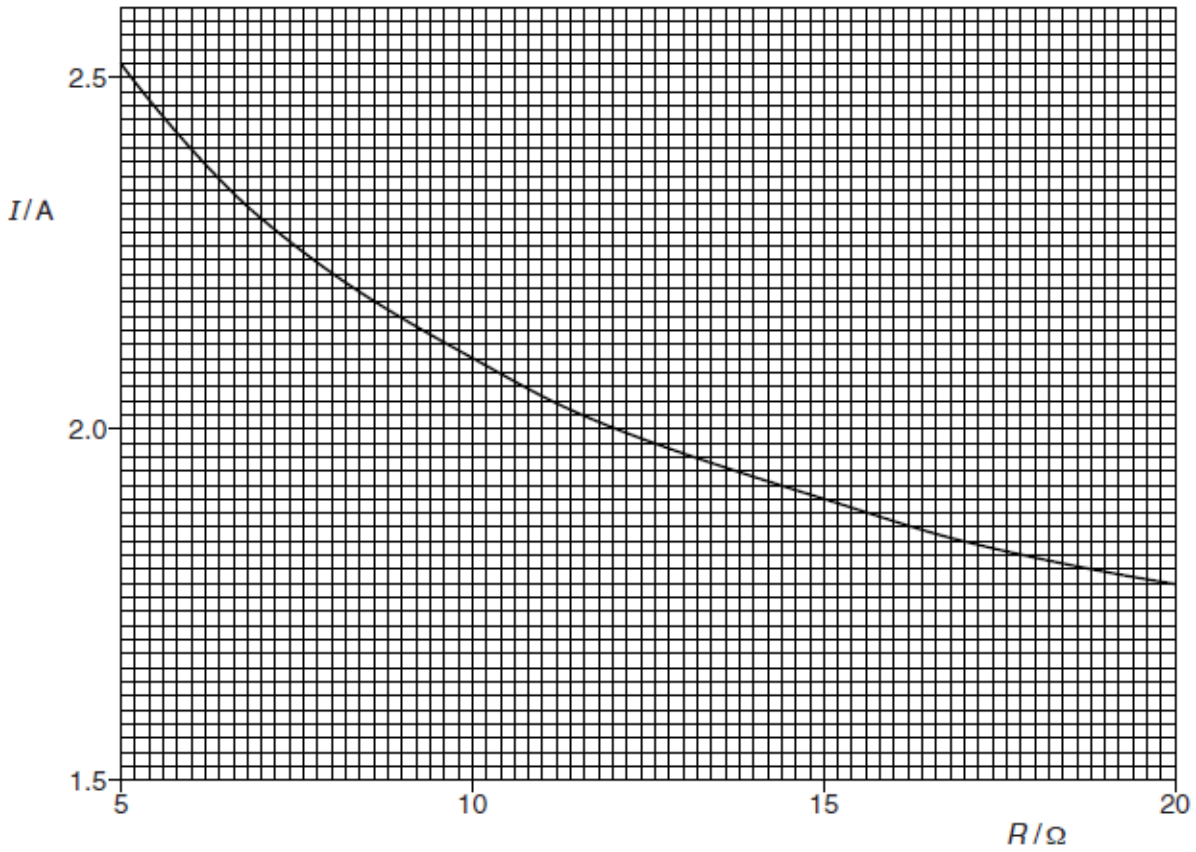

Fig. 3.2

(a) Explain why the potential difference (p.d.) between points A and C is 24 V for all values of *R*.

……

…… [1]

(b) Use Fig. 3.2 to state and explain the variation of p.d. across resistor Y as *R* is increased. Numerical values are not required.

……

……

…… [2]

(c) For *R* = 6.0 Ω,

(i) show that the p.d. between A and B is 9.6 V,

[2]

(ii) calculate the resistance of X,

resistance = ... Ω [3]

(iii) calculate the power provided by the battery.

power = ... W [1]

(d) State and explain qualitatively how the power provided by the battery changes as the resistance *R* is increased.

……

…… [1]

[Total: 10]