

- 1 Fig. 9.1 shows a 12 V battery connected in a circuit containing resistors A, B, C and D. Each resistor has a resistance of 6.0Ω .

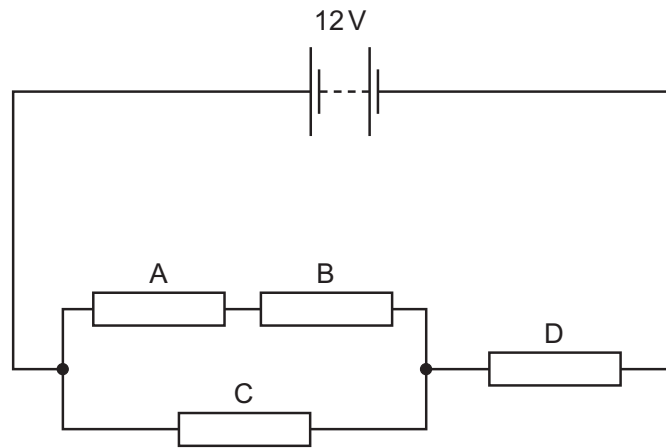


Fig. 9.1

(a) Calculate the combined resistance of

- (i) resistors A and B,

series: $6+6 = 12$
 resistance = [1]

- (ii) resistors A, B and C,

parallel $1/R = 1/12 + 1/6 = 4$
 resistance = [2]

- (iii) resistors A, B, C and D.

series: $4 + 6 = 10$
 resistance = [1]

(b) Calculate

(i) the current in the battery,

current = $I = V/R = 12/10 = 1.2A$ [1]

(ii) the energy transferred from the battery to the circuit in 50 s.

energy transferred = $E = Pt = IVt = 10 \cdot 1.2 \cdot 50 = 6000J$ [2]

[Total: 7]

- 2 Fig. 2.1 shows a conveyor belt transporting a package to a raised platform. The belt is driven by a motor.

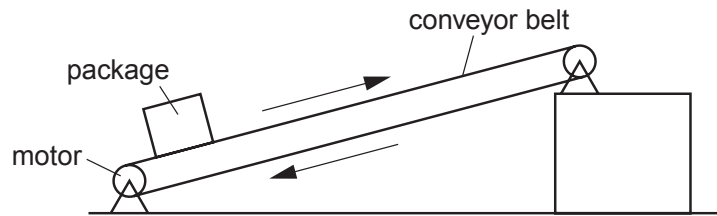


Fig. 2.1

- (a) The mass of the package is 36 kg.

Calculate the increase in the gravitational potential energy (g.p.e.) of the package when it is raised through a vertical height of 2.4 m.

$$\text{gpe} = mgh = 36 * 9.8 * 2.4 = 850\text{J}$$

increase in g.p.e. = [2]

- (b) The package is raised through the vertical height of 2.4 m in 4.4 s.

Calculate the power needed to raise the package.

$$P = \text{work} / \text{time} = 850 / 4.4 = 192\text{W}$$

power = [2]

- (c) The electrical power supplied to the motor is much greater than the answer to (b).

Explain how the principle of conservation of energy applies to this system.

the electrical energy delivered by the motor is converted into gpe of the package but also into waste heat due to electrical resistance.

..... [2]

- (d) Assume that the power available to raise packages is constant. A package of mass greater than 36 kg is raised through the same height.

Suggest and explain the effect of this increase in mass on the operation of the conveyer belt.

The belt would lift the heavier package more slowly because it is gaining gpe at the same rate as the lighter package but due to its greater mass does not need to rise as high for the same gain in gpe per unit time.

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..... [3]

[Total: 9]