Problem Set 8 – single-resistor circuit

1. The filament of a light bulb carries a current of 0.5 A when connected to a 120-V source.

(a) What amount of charge passes through the filament in 30 seconds?

(b) How many electrons pass through the filament in 30 seconds?

(c) What is the resistance of the filament?

(d) What is the power rating of the bulb?

(e) How much energy in joules and in kilowatt-hours does the bulb consume if the bulb is left on for

18 hours?

2. How much current does a radio draw from a 9 V battery if the resistance of the radio is 2000 Ω?

3. What voltage source is required to supply 1.2 A to a 5-Ω motor?

4. Electrical energy costs $0.10 per kWh. For how much time can I light a 100 W lamp with $1’s worth of electricity?

5. What is the power consumption of each of these devices?

(a) a 200-Ω resistor that draws 0.5 A

(b) a 200-Ω resistor connected to a 24 volt battery

(c) a vacuum cleaner that draws 14 A from a 120 V wall outlet

6. What is the resistance of the filament in each of these light bulbs which operate from a 120 V source?

(a) a 40-W bulb

(b) a 60-W bulb

(c) a 100-W bulb

7. A power supply is described as 6 V at 5 W. The 5 W tells the maximum power output the power supply can produce without damage. What is the smallest resistance that should be connected to this power supply?

8. An electric motor draws 1.5 A at 18 V for 6 seconds. The motor pulls a 9-kg object from rest across a level, frictionless surface during the 6 seconds. The speed of the object is 3 m/s after 6 seconds.

(a) What was the power consumption of the motor?

(b) What was the energy input to the motor?

(c) What was the change in the kinetic energy of the object?

(d) How much work did the motor do on the object?

(e) What was the % efficiency of the motor? **% efficiency = (output work/input energy)(100)**

(f) What was the magnitude of the acceleration of the object?

(g) How far did the motor pull the object?

(h) What average force did the motor exert on the object?

ANSWERS

1. (a) 15 C 4. 100 hours or 4.2 days 7. 7.2 Ω

(b) 9.4 x 1019 electrons

(c) 240 Ω 5. (a) 50 W 8. (a) 27 W

(d) 60 W (b) 2.9 W (b) 162 J

(e) 3.9 X 106 J or 1.08 kWh (c) 1680 W (c) 40.5 J

(d) 40.5 J

2. 4.5 X 10-3 A 6. (a) 360 Ω (e) 25%

(b) 240 Ω (f) 0.5 m/s

3. 6 V (c) 144 Ω (g) 9 m

(h) 4.5 N