Current

1) How much electric current is there when 12 C of charge passes a point in a conductor in 4.0 sec?

3.0 Amp

2) What is the current through a light bulb when it takes 24 sec for 18 C of charge to pass through its filament?

$\frac{18\,C}{24\,sec} = .75$ Amp

3) How much charge passes through the starting motor, if it takes 4.0 sec to start a car and there is a current of 225 A during that time?

$Q = 900\,C$

4) A small electric motor draws a current of 0.40 A. How long will it take for 8.0 C of charge to pass through it?

$.40 = \frac{8.0}{t}$ $t = 20$ sec

5) How many electrons pass through a light bulb in each second if the bulb has a current of 0.50 A through it?

$.50C \times \frac{1\ electron}{1.602 \times 10^{-19}\,C} = 3.12 \times 10^{18}$ electrons

6) An electric baseboard heater draws a current of 6.0 A and has a potential difference of 240 V. For how long must it run to produce 2.2×10^5 J of heat? (Assume all energy is converted to heat)

$2.2 \times 10^5 = Q(240)$
$Q = 917N$

$6.0 = \frac{917}{t}$ $t = 153$ sec

7) Calculate the energy stored in a 9V battery that can deliver a continuous current of 5.0 mA for 2000 seconds.

$.005 = \frac{Q}{2000}$ $Q = 10\,C$ $PE = 9(10) = 90\,J$

8) An electric motor is used to do the 9600 J of work needed to lift a small load. If the motor draws a current of 2.0 A for 20 sec, what is the potential difference across the motor?

$9600 = (40)V$
$V = 240V$

$2.0 = \frac{Q}{20}$ $Q = 40\,C$

9) How much energy does an electric drill use if it has a potential difference of 120 V and draws a current of 7.5 A for 50 seconds to drill a hole in a piece of steel?

$7.5 = \frac{Q}{50}$ $Q = 375\,C$ $PE = 120(375)$
$= 45000J$

10) A net charge of 30 C passes a point on a wire in 2.0 min. What is the current in the wire?

$I = \frac{30C}{120\ sec} = .25\ A$

11) How long will it take 1.56×10^{19} electrons to pass a location in a wire so as to produce a steady current of 5.0 mA?

$1.56 \times 10^{19} \times \frac{1.602 \times 10^{-19}\ C}{1\ e} = 2.5\ C$

$.005 = \frac{2.5}{t}$

$t = 500\ sec$

12) A small toy car draw 0.50 mA of current from a 3.0 V battery. In 10 min of operation

a) How much charge flows through the car

b) How much energy is lost by the battery

a) $.00050 = \frac{Q}{600}$

$Q = .30\ C$

b) $PE = QV$

$PE = (.30)(3.0) = .90\ J$

13) A car motor draws 50 A when starting up. If the start-up time is 1.5 sec, how many electrons pass during this time?

$50 = \frac{Q}{1.5}$

$Q = 75\ C \times \frac{1\ elect}{1.602 \times 10^{-19}\ C} = 4.7 \times 10^{20}\ elect's$

14) A net charge of 20 C passes a spot in a wire of cross-sectional area 0.30 m^2 in 1.25 min; a net charge of 30C passes a location in another wire of cross-sectional area 0.45 cm^2 in 1.52 min. Which wire carries more current?

$I = \frac{20}{75} = .27\ A$

$I = \frac{30}{91.2} = .33\ A$

$.45\ cm^2$ wire is greater

15) How many coulombs are there in a 75 ampere-hour car battery?

75 Amp

1 hour = 3600 sec

$75 = \frac{Q}{3600}$

$Q = 270{,}000\ C$