Power

Power - Rate at which energy is supplied or work is done

$P = \frac{W}{t}$

$P = VI$

V - Potential Difference (Work) I - Current (related to time) Unit Watts

$P = VI = I^2R = \frac{V^2}{R}$

Ex 1 Calculate the rate at which power is supplied by a 120V source to a circuit if the current is 5.5A

$P = VI$

$(120V)(5.5A) = 660W$

Ex 2 A 150Ω resistor carries a current of 2.0A. Calculate the rate at which power is produced by the resistor

Given $R = 150\Omega$ $I = 2.0A$

$P = I^2R$ $P = (2.0A)^2(150\Omega) = 600W$

Electric Energy The capacity for doing work

Energy = Power · time

$W = VIt = I^2Rt = \frac{V^2}{R} \cdot t$

3 How much energy is produced by a 50V source that generates a current of 5A for 2 minutes

$W = VIt$

$(50V)(5A)(120s) = 30{,}000J$

Name Key Date _____

Commack High School
Regents Physics

Worksheet: Electric Currents

1. The electric field intensity between two charged metal plates is 800. N/C. The plates are 0.5 m apart. What is the difference in potential between them?
$V = E \cdot d$ $V = 800 \frac{N}{C} \cdot .5m = 400 V$

2. A voltmeter reads 500. V when placed across tow parallel plates. The plates are 0.02 m apart. What is the electric field intensity between them?
$V = E \cdot d$ $E = \frac{V}{d} = \frac{500V}{.02m} = 25{,}000 \frac{N}{C}$

3. What voltage is applied to two metal plates 0.05 m apart if the field intensity between them is 2500 N/C?
$V = E \cdot d$ $V = 2500 \frac{N}{C} \cdot (.05m) = 125V$

4. A generator transfers 1.0 C of charge through a potential difference of 110Volts. $Q = 1C$ $V = 110V$

   a. What work does the generator do?
   $V = \frac{W}{q}$ $W = V \cdot q$ $W = 110V(1C) = 110 J$

   b. What is the potential energy of 1.0 C of charge after the transfer?
   110 J

5. A generator transfers 50.0 C of charge through a potential difference of 110V.
$q = 50C$ $V = 110V$

   a. What work does the generator do to transfer the charge?
   $V = \frac{W}{q}$ $W = V \cdot q$ $W = (50)(110V) = 5500 J$

   b. The generator accomplishes this work in 5.0 seconds. How much work does it do per second? $W = F \cdot d$
   1,100 J

   c. What power does the generator deliver in watts? In kilowatts?
   $W = Pt$ $5500J = P(5s)$ $P = 1100W$ or $1.1KW$

6. The current through a light bulb connected across the terminals of a 120 V outlet is 0.5 amps. At what rate does the bulb use electrical energy?
$I = .5A$, $V = 120V$ $P = VI = 120V(.5A) = 60W$

7. A toaster connected to a 120V source uses 4.0 amps of current. What power does the toaster use? $V = 120V$ $I = 4A$
$P = VI = 120V(4A) = 480W$

8. What current flows through a 75 Watt light bulb connected to a 120 V outlet?
$P = 75W$, $V = 120V$ $P = IV$ $75W = I(120V)$ $I = .625A$

9. The current through a motor connected to a 60 V battery is 2.0 amps. What energy in joules does the motor use in 5.0 minutes.
$V = 60V$, $V = 60V$
$I = 2A$
$W = ?$
$t = 300s$
$W = VIt$
$W = 60V(2A)(300s)$
$W = 36{,}000 J$

10. A lamp draws 0.5 amps from a 120V generator.

$I = 0.5\,A \quad V = 120\,V$

a. How much power does the generator deliver?

$P = IV = .5A(120) = 60W$

b. How much energy does the lamp use in 5.0 minutes?

$W = Pt = 60W(300s) = 18{,}000J$

11. A resistance of 30.0 Ω is placed across a 90.V battery. What current flows in the circuit? $R = 30\Omega \quad V = 90V \quad I = ?$

$R = \frac{V}{I} \quad 30\Omega = \frac{90V}{I} \quad I = 3A$

12. A current of 0.5 amps flows through a lamp when it is connected to a 120 V source. $I = .5A \quad V = 120V$

a. What is the resistance of the lamp?

$R = \frac{V}{I} = \frac{120V}{.5A} = 240\Omega$

b. What is the wattage of the lamp?

$P = IV = .5A(120V) = 60W$

13. A 15 Ω electric heater operates on a 120V outlet.

$r = 15\Omega \quad V = 120V$

a. What current flows through the heater?

$R = \frac{V}{I} \quad 15\Omega = \frac{120V}{I} \quad I = 8A$

b. How much energy is used by the heater in 30. seconds?

$W = I^2rt = (8A)^2(15\Omega)(30s) = 28{,}800\,J$

c. How much heat is liberated by the heater in this time?

28,800 J

14. A 30.0 Ω resistor is connected to a 60.V battery.

$R = 30\Omega \quad V = 60V$

a. What is the current in the circuit?

$V = IR \quad 60V = I(30\Omega) \quad I = 2A$

b. How much energy is used by the resistor in 5.0 minutes?

$W = VIt \quad 60V(2A)(300s) = 36{,}000\,J$

15. A 100 Watt light bulb is 20% efficient.

$P = 100W \quad P = 20W$ Light

a. How many joules does the light bulb convert into light each minute it is in operation?

$W = Pt \quad 1200\,J$

$W = 20W(60s) =$

b. How many joules of heat does the light bulb produce each minute?

$W = 80W(60s) = 4{,}800$