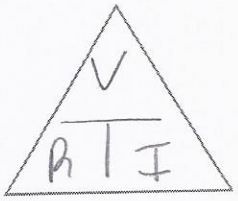
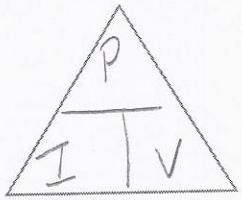
Formula and Multiple Formula Review

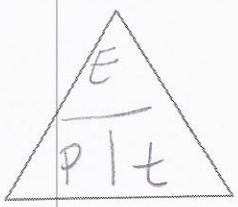
V=RI



P=IV



E=Pt



E=IVt

Conversions: Must memorize

Minutes to seconds × 60
Seconds to minutes ÷ 60
Hours to seconds × 3600
Seconds to hours ÷ 3600

J to kJ ÷ 1000
J to kWh ÷ 3 600 000
W to kW ÷ 1000
kW to W × 1000

1. How much power did it take to use a microwave for 3 minutes which consumed 75 000 J of energy?

$P = \frac{E}{t}$ $\frac{75000}{(3 \times 60)} = 416.7\ W$

2. If a TV used 650 000 J of energy and 110 W of power. How many hours did you watch TV for?

$t = \frac{E}{P}$ $\frac{650\,000}{110} = \frac{5909.1}{3600} = 1.7\ hrs$

3. What is the resistance of a resistor if a circuit is on for 7 minutes, used 6 000 J of energy and had 1.5 A?

$R = \frac{V}{I}$ $\frac{9.5}{1.5}$ $6.3\ \Omega$ $V = \frac{E}{It}$ $\frac{6000}{(7 \times 1.5 \times 60)} = 9.5\ V$

4. A hairdryer is used for 10 minutes a day. It runs on 190 V and 9 A. How much energy is used in kJ ?

$E = IVt$ $\frac{9 \times 190 \times 10 \times 60}{1000} = 1026\ kJ$

5. How much time was a radio on when it needed 0.3 A, 200 V and 45 000 J of energy?

$t = \frac{E}{IV}$ $\frac{45000}{(.3 \times 200)} = 750\ s$

6. A man watched TV for 7 hours and used 900 W of power. How much energy was used?

$E = Pt$ $900 \times 7 \times 3600 =$ 22 680 000 J

7. What is the resistance of a resistor if a circuit is on for 28 minutes, used 25 000 J of energy and had 3 A?

$R = \frac{V}{I}$ $\frac{5.0}{3} =$ 1.7 Ω $V = \frac{E}{It}$ $\frac{25\,000}{(3 \times 28 \times 60)} =$ 5.0 V

8. Some of the characteristics of an MP3 player are listed below.
   - Potential difference: 1.5V
   - Electric current intensity: 0.1 A
   - Energy stored in the battery: 21 600 J

   Given the energy stored in its battery, what is the maximum amount of time in minutes this MP3 player can be used?

$t = \frac{E}{Iv}$ $\frac{21600}{(.1 \times 1.5)} = \frac{144\,000}{60} =$ 2400 min

9. Your parents have a swimming pool that consumes 3 500 kWh of energy during the time it is used.

- Number of days used in the year = 112 days
- Amount of time used per day = 4 hours/day

They want to replace it with a new swimming pool heater that has the following characteristics:

Voltage = 240 V Current intensity = 20 A

Will the new swimming pool heater consume less energy? Justify your answer.

2150.4 kWh

$E = IVt$ $\frac{20 \times 240 \times 4 \times 3600 \times 112}{3\,600\,000} =$ ~~2342.4~~

Yes will consume less energy

10. The rating plate of an electric oven indicates that it has a power of 2300 W. This oven was used for 40 minutes. How much energy did this oven consume in kWh for this situation?

$E = Pt$ $\frac{2300 \times 40 \times 60}{3\,600\,000} =$ 1.5 kWh

11. A clothes dryer operates at a potential difference of 140 V and a current intensity of 24 A for 70 minutes. How much energy in W•h, does the clothes dryer consume?

$E = IVt$ $\quad 24 \times 140 \times 70 \div 60 =$ 3920 W.h

12. Each of these four appliances is used for one hour. Which one of these appliances is the most expensive to use?

Appliance 1	Appliance 2	Appliance 3	Appliance 4
800 W 120 V 60 Hz	1200 W 10 A 120 V	17 A 240 V 60 Hz	20 A 120 V

1
$800 \times 1 \times 3600$
2 880 000 J

2
$1200 \times 1 \times 3600$
4 320 000 J

3
$17 \times 240 \times 1 \times 3600$
14 688 000 J
most expensive

4
$20 \times 120 \times 1 \times 3600$
8 640 000 J

13. What is the power of an appliance if it works on 12 A and has a 5 Ω resistor?

$P = IV$
$12 \times 60 =$ 720 W

$V = RI$
$5 \times 12 = 60$ V

14. How much energy in kJ does a computer use if it is on for 40 minutes and uses 200 V and 2.0 A.

$E = Ivt$ $\quad \frac{2 \times 200 \times 40 \times 60}{1000} =$ 960 kJ

15. Which of the children below is wasting the most energy?

	Appliances	Total Powers used	Total Time on
Child 1	TV, computer and radio	6.0 kW	15 hrs
Child 2	Computer and radio	1 200 W	3 500 min
Child 3	Lights, computer	4.2 kW	14 hrs
* Child 4	Lights, computer and TV	1 800 W ×	4400 min × 60 = 475 200 000 J

1
$E = Pt$
$6 \times 1000 \times 15 \times 3600$
324 000 000 J

2
$1200 \times 3580 \times 60$
252 000 000 J

3
$4.2 \times 1000 \times 14 \times 3600$
211 680 000 J

16. What is the power of an appliance if it works on 3.5 A and has a 12 Ω resistor?

$P = IV$

$3.5 \times 42 = 147\ W$

$V = RI$

$3.5 \times 12 = 42\ V$

17. Johnny wants to install a stereo system in his room. The problem is he does not have a lot of amps left to install the system because of all the other electrical systems he uses. He calculates that he can only have a stereo that does not exceed 3 A. Below are the options of stereos he can use.

Stereo options:

	Power (W)	Voltage (V)
Stereo A	800	120
Stereo B	400	120
Stereo C	400	110
Stereo D	250	110

$I = \frac{P}{V}$

Determine if any of the systems can be used.

A: $\frac{800}{120} = 6.7A$

B: $\frac{400}{120} = 3.3A$

C: $\frac{400}{110} = 3.7A$

D: $\frac{250}{110} = 2.3A$

only D

18. Your power in the kitchen runs on 120 V and 20 A. You have the following appliances in the kitchen:

Stove 400 W Fridge 500 W Dishwasher 300 W

You need to purchase a microwave, there are 3 possible options to choose from:

Option A	Option B	Option C
~~120 V and 15A~~ 1800W	~~120 V and 4 A~~ 480W	~~120 V and 9 A~~ = 1080W

You want to use the microwave that ahs the most power, but that would not exceed the total amount of power available in the kitchen. Which microwave would you choose? Justify your answer.

Max Power

$P = IV$

120×20

2400W

$2400 - 400 - 500 - 300 = 1200W$ left over

Use option C