GCSE Physics AQA Topic 2

1. A current of 12 amps flows around a circuit. How much time does it take for a charge of 50C to pass a point in the circuit **(4.17s)**
2. 600C of charge moves around a circuit in two minutes. What is the current in the circuit. **(5A)**
3. 12 kC of charge moves through a battery charger in one day. What was the current of the circuit. **(0.14A)**
4. What is the current to allow 300C to be passed through a light bulb in 5 minutes. **(1A)**
5. How much current flows in a circuit with 12Ω resistance and a supply voltage of 24V. **(2A)**
6. 15 amps pass through a lamp with a resistance of 23**Ω**. What is the potential difference across the resistor. **(345V)**
7. A circuit is supplied with 3V. The circuit draws a current of 15 amps. Calculate the total resistance in the circuit. **(0.2Ω)**
8. Find the resistance of a circuit with a potential difference of 10V and a current of 2A. **(5Ω)**
9. Blah blah blah blah blah blah 9V. Blah blah 3A. Blah blah blah blah calculate resistance. **(3Ω)**
10. 35V is applied across a component with 20Ω resistance. Calculate the time it takes for a charge of 180C to move through the resistor. **(I = 1.75A, t = 102s).**
11. A power station operates at 45% efficiency, generating an output of 10MW. Calculate the total energy input into the power station. **(22MW).**
12. A power generator is 34% efficient. It generates 500MW of energy.
Calculate how much energy is lost in the generation process. **(970MW)**
Calculate how much energy would be generated if efficiency was to rise to 37%? **(544MW)**
13. Calculate the total amount of energy converted in a 2kW kettle
A. per second **(2000J)**
B. In the 5 minutes it takes the kettle to boil (**600000J)**
14. An electrical appliance converted 360000J every hour. Calculate its power rating. **(100W)**
15. How much energy does 60W light bulb that is on 3hrs a day, use in a whole year? **(237 MJ)**
16. A light bulb has a resistance of 4**Ω** and a supply voltage of 30V. Calculate the energy converted in the light bulb every minute.
Hint: calculate current first. Then calculate power. Then calculate energy. You need to use three equations! **(13.5kJ)**
17. The National Grid supplies a house with 18000000J of energy every hour. What is the average current supplied to the house during the hour?
Hint: Calculate the power from the energy. Calculate the current from the power. You are assumed to know the voltage. Why? (22A).

Annotated answers

1. A current of 12 amps flows around a circuit. How much time does it take for a charge of 50C to pass a point in the circuit **(4.17s)**
Use the equation Q = It
50C = 12A x t
t = 50 / 12
t = 4.17s

2. 600C of charge moves around a circuit in two minutes. What is the current in the circuit. **(5A)**

First convert minutes into seconds. 2 x 60 = 120s
Substitute values into the equation Q = It
600C = I x 120s
I = 600/ 120
I = 5A

3. 12 kC of charge moves through a battery charger in one day. What was the current of the circuit. **(0.14A)**

First convert kC into C. 12kC = 12 x 1000 = 12000C
Convert 1 day into seconds. First convert hours into minutes 24 x 60 = 1440 minutes. Next convert minutes into seconds 1440 x 60 = 86400s
Substitute the values into the equation Q = It
12000C = I x 86400s
I = 12000/86400 = 0.14A

4. What is the current to allow 300C to be passed through a light bulb in 5 minutes. **(1A)**

Convert minutes into seconds 5 x 60 = 300s
Substitute values into equation Q=I x t
300C = I x 300s
I = 300A/300s = 1A

5. How much current flows in a circuit with 12Ω resistance and a supply voltage of 24V. **(2A)**
Substitute values into the equation V = IR
24V = I x 12 Ω
I = 24/ 12 = 2A

6. 15 amps pass through a lamp with a resistance of 23Ω. What is the potential difference across the resistor. **(345V)**

Substitute values into the equation V=IR
V = 15A x 23Ω
V = 345V

7. A circuit is supplied with 3V. The circuit draws a current of 15 amps. Calculate the total resistance in the circuit. **(0.2Ω)**

Substitute values into the equation V=IR

3V = 15A x R

R = 3/15 = **0.2Ω**

8. Find the resistance of a circuit with a potential difference of 10V and a current of 2A. **(5Ω)**

Substitute the values into the equation V=IR

10V=2A x R

R = 10V/2A

R = **5Ω**

9. Blah blah blah blah blah blah 9V. Blah blah 3A. Blah blah blah blah calculate resistance. **(3Ω)**

The point of this question is to get you to focus on the important information in the question

Substitute the values into the equation V=IR

9V = 3A x R

R = 9V / 3A

R = **3Ω**

10. 35V is applied across a component with 20Ω resistance. Calculate the time it takes for a charge of 180C to move through the resistor. **(I = 1.75A, t = 102s).**

In this question you need to use two equations to get to the final answer. Normally you would use Q=It but you are not given current so you cannot calculate the time. So use the other information to calculate the current first.

Substitute values into the equation V=IR

35V = I x 20Ω

I = 35V/20Ω

I = 1.75A

You can now substitute values into the equation Q=It

180C=1.75A x t

t = 180C/1.75A

t = 102s

11. A power station operates at 45% efficiency, generating an output of 10MW. Calculate the total energy input into the power station. **(22MW).**

This is less of a physics question and more of a % question from maths. On the physics side the total energy input is maximum energy. The output quoted is useful energy. The remaining 55% is dissipated to non useful stores.

10MW / 45 will give us 1% = 0.22

Total energy input = 0.22 x 100 = 22MW

12. A power generator is 34% efficient. It generates an output of 500MW of useful energy.

Calculate how much energy is lost in the generation process. **(970MW)**

Calculate how much energy would be generated if efficiency was to rise to 37%? **(544MW)**

This is similar to question 11 but worded differently.
First calculate the total input energy
500MW/34 = 1% total input energy
% total input energy = 14.7
total input energy = 14.7 x 100 = 1470Mw
The question asks for the energy dissipated (lost)
Total input energy = total useful output energy + dissipated energy
Rearranging this
Dissipated energy = total input – total useful output energy
Dissipated energy = 1470MW – 500MW = 970MW
The second part of the question is based on an improved efficiency. Even though the efficiency (the amount transferred to useful energy) has increased the total input remains the same
1470MW / 100 =14.7 x 37 = 544MW

13. Calculate the total amount of energy converted in a 2kW kettle
A. per second **(2000J)**
B. In the 5 minutes it takes the kettle to boil (**600 000J)**

We use the equation energy = power x time
First convert kW into W. 2kw (x1000) = 2000W
Substitute the values into the equation
Energy = 2000W x 1s
Energy = 2000J (remember the unit for power is W and energy is J)

For part B we will use the same equation again: energy = power x time
First convert minutes into seconds
5minutes x 60 = 300 seconds
Substitute the converted values into the equation
Energy = 2000W x 300s
Energy = 600 000J

14. An electrical appliance converted 360000J every hour. Calculate its power rating. **(100W)**
Use the equation: energy = power x time
First convert 1 hour into seconds
1 hour x 60 = 60 minutes.
60 minutes x 60 = 3600 seconds (it is worth learning that 1 hour = 3600 seconds to save time in exams)
Substitute the values into the equation
360 000J = power x 3600s
Divide the left hand side by the right hand side
Power = 360 000 x 3600
Power = 100W

15. How much energy does 60W light bulb that is on 3hrs a day, use in a whole year? **(237 MJ)**
This is an annoying question because you have to convert numbers into seconds.
Use the equation: energy = power x time
First calculate the total number of hours the light bulb is on
3hrs x 365 = 1095 hours
Next convert hours into seconds
1095 hours x 60 = 65700 minutes

Convert minutes into seconds
65700 x 60 = 3 942 000s
Substitute the values into the equation
Energy = 60W x 3 942 000 = 236 520 000J (/1000 = 236 520 kJ, /1000 = 237MJ)

16. A light bulb has a resistance of 4Ω and a supply voltage of 30V. Calculate the energy converted in the light bulb every minute.
Hint: calculate current first. Then calculate power. Then calculate energy. You need to use three equations! **(13.5kJ)**

As the hints suggest use the equation: voltage = current x resistance
Substitute the values into the equation
30V = I x 4Ω
Divide the number on the left by the number on the right
I = 30V / 4Ω
I = 7.5A
We can now use the equation: power = voltage x current
Power = 30V x 7.5A
Power = 225W
Now we have the power use the equation: energy = power x time
First convert 1 minute into seconds = 1 x 60 = 60 seconds
Substitute values into the equation
Energy = 225W x 60
Energy = 13 500J

17. The National Grid supplies a house with 18000000J of energy every hour. What is the average current supplied to the house during the hour?
Hint: Calculate the power from the energy. Calculate the current from the power. You are assumed to know the voltage. Why? (22A).
There is a trick in this question. It appears you are not given voltage! However, if a question says that the National Grid supplies a house you can assume that the voltage = 230V.
Use the equation: Energy = power x time
First convert 1 hour into seconds.
1 hour x 60 = 60 minutes.
60 minutes x 60 = 3600 seconds (it is worth learning that 1 hour = 3600 seconds to save time in exams)
Substitute the values into the equation
18 000 000J = power x 3600s
Divide the number on the left by the number on the right
Power = 18 000 000J / 3600s
Power = 5000W
Next use the equation: power = voltage x current
Substitute the values into the equation
5000W = 230V x current
Divide the number on the left by the number on the right
Current = 5000W / 230V
Current = 22A