ELECTRONICS

SUMMER TASK FOR STUDENTS STARTING SEPTEMBER 2023

We are really looking forward to you starting your JLC journey with us in September. To prepare you for starting your course, please complete the following task:

Answer the questions below on spare paper or in a booklet. Keep it safe, we will go through answers in the first week of lessons. Take a photo of your work in case you lose it or it gets damaged.

1. 630000 in standard form is 6.3×10^5, convert the below into standard form.

800	3400	730000	6.5	123000

2. 0.0045 in standard form is 4.5×10^{-3}, convert the below into standard form.

0.031	0.4	0.289	0.000047	0.00000077

3. Prefixes are often used in electronics. Many values are ‘kilo-something’. An electronics example is the kilowatt, kW, which is 1000 Watts, W. So, for example, 12500W = 12.5kW. If you are unsure, divide by 1000. Convert the following powers into kW.

13000W	7300W	14400W	9000000mW	8700000mW

4. Other prefixes are used when something is small. In the previous question I put in mW, or ‘milliwatts’. The symbol μW is read as ‘microwatts’, it means a million times smaller; so one microwatt is one millionth of a watt. The other way around, there are one million microwatts in a watt. As an example, 0.000444W = 444μW. To convert I multiplied by 1000000, a million. Convert the following into microwatts.

0.000002W	0.00033W	0.0000567W	0.008W	0.00000001W

5. For the final two answers in Q4, convert 0.008W using a more appropriate prefix than μW. Convert 0.00000001W into a more appropriate prefix than μW, it is a different prefix than you will use for 0.008W.

6. Convert the following back to watts, W.

0.4kW	1.77kW	33000mW	5920000µW	90000000000µW

7. Draw the circuit symbol for the following components and explain what they do.

Cell	Battery	Ammeter	Fixed Resistor	Bulb/Lamp

8. Below are some descriptions of circuit components. Draw the circuit symbols for them.

    A. Measures voltage (potential difference) across another component.

    B. Allows you to choose if current flows or not.

    C. Changes resistance at different temperatures.

    D. Allows current to flow in only one direction.

    E. Causes rotation when powered.

9. Draw the following circuits as a circuit diagram.

    A. A series circuit with two bulbs and a cell.

    B. A parallel circuit with two bulbs and a cell.

C. A circuit of three bulbs and one cell which has series and parallel components.

D. A circuit that would allow you to determine the current through and voltage (potential difference) across a resistor.

10. Resistance is a property of all components, not just ones called resistors. Resistance, R, is voltage (potential difference) divided by current. For example, if a resistor has 0.1A of current through it and 6V of voltage (potential difference) across it, the resistance is $R = V/I = 6/0.1 = 60\Omega$. Calculate the resistance in the following scenarios.

A. A resistor has 12V of voltage across it and 2A of current through it.

B. Another resistor has 4.9V across it and 0.07A through it.

C. A diode has 0.4V across it and 0.000008A through it.

D. The same diode has 0.7V across it and 0.0035A through it.

E. The same diode has 1.1V across it and 0.55A through it.

11. Components may or may not keep the same value of resistance in different scenarios. For example an NTC thermistor is a component whose resistance is high in the cold and low when it is hot; but not all components have a changing value of resistance. Answer the following:

A. Why is a fixed resistor called a fixed resistor?

B. Following on from part A, If this fixed resistor has a voltage of 165V across it and 0.05A of current through it, calculate its resistance.

C. Following on from part B, the voltage is increased to 330V, double the previous 165V value. What happens to the current and why?

D. Following on from part C, the voltage is increased to 990V, what is the new current through it?

E. Compare the calculated resistances of the diode from question 6 parts C, D and E. What happens to the resistance as the voltage increases.

Challenge: Resistors may be placed in series or in parallel, one model of resistors treats them like toll booths where cars stop to pay a fee known as a toll in exchange for having used the road. What do the following represent:

A. The cars.

B. The road.

C. The money.

D. The flow of traffic.

E. The toll booth.