|  |  |
| --- | --- |
| Student’s Name | **ANSWER KEY** |
| Date |  |
| Lecturer’s Name | **ANSWER KEY** |

**Instructions to Students**

* All work to be done on an individual basis.
* Time allowed – 2 hours
* Attempt all questions
* The marks for each question are identified after the question.
	+ ***In order to obtain full marks, for those questions that require calculations, you must provide working out. No working then only 1 mark will be allocated.***
* The total marks for the Assignment is (152)
* Pass mark = 70% (107)
* Place your answers in the space provided
* Return all pages on completion of period.
1. Complete the following table: (11 Marks)

|  |  |  |  |
| --- | --- | --- | --- |
| Quantity | Formula Symbol | Quantity Symbol | Unit |
| Voltage | V | V | Volt  |
| Current | I | A | Amps |
| Power | P | W | Watts |
| Resistance | R | Ω | Ohms |

# Indicate the direction of conventional and electron current flow as appropriate

# : (4)

|  |  |
| --- | --- |
|  |  |
| Conventional | Electron |

# Explain the function of the following devices when used within an electric circuit:

#  (10)

## Switch

A control for turning devices on and off

## Fuse

A safety device that opens the circuit automatically when too much current flows

## Slow blow fuse

A fuse that is designed to withstand a surge current for a short duration before “blowing” or going open circuit.

## Circuit breaker

A safety device that opens the circuit when excessive current flows, and can be manually reset

## Earth leakage circuit breaker (RCD)

A Safety device that opens the circuit automatically when any current flows in the Earth Path. As well as performing the task for a circuit breaker. (25)

# Complete the following table (25)

|  |  |  |  |
| --- | --- | --- | --- |
| Metric Prefix | Meaning Of Prefix | Symbol | Standard Engineering Notation |
| micro | times by 0.000,001 | µ | 10-6 |
| milli | times by 0.001 | M | 10-3 |
| GIGA | Times by 1,000,000,000 | G | 109 |
| Mega | times by 1,000,000 | M | 106 |
| nano | times by 0.000,000,001 | N | 10-9 |
| pico | Times by 0.000,000,000,001 | P | 10-12 |
| kilo | Times by 1,000 | k | 10 3 |
| TERRA | Times by 1,000,000,000,000 | T | 1012 |
|  | Times by 1 |  | 100 |

# Sketch a circuit (figure 3) containing a voltage source, a fuse, a switch, a lamp, a voltmeter and an ammeter. The two meters are to be connected, with the appropriate polarity, in order measure the voltage applied to the lamp and the current in the circuit.

#  (10)

Ammeter

Voltmeter

# List three examples of each of the following types of materials: (9)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Conductors |  | Semi-Conductors |  | Insulators |
| Copper |  | Carbon |  | Plastic |
| Gold |  | Silicon |  | Glass |
| Aluminium |  | Germanium |  | Mica |

 (69)

# 7. List six methods of creating electrical energy: (6)

Chemical

Magnetic

Friction / Static

Piezo

Photo

Thermal

8. Describe the effects of passing a Current through a wire. (2)

Magnetic field is generated

Heat

1. List the factors that affect the value of resistance (4)

Type of material

Cross sectional area

Length

Temperature

1. Match the following terms (3)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Electric Charge | a | Coulomb | 1 | Voltage |
| Electric Current | b | Ampere | 2 | Coulomb |
| ElectroMotive Force | c | Voltage | 3 | Ampere |

1. Refer to the figure 4. Identify the switch position that best describes open circuit, short circuit or closed circuit (3)

|  |  |
| --- | --- |
| figure1Figure 4 | Switch Position |
| 1 | * 1. **open circuit,**
	2. short circuit
	3. closed circuit
 |
| 2 | * 1. open circuit
	2. short circuit
	3. **closed circuit**
 |
| 3 | * 1. open circuit,
	2. **short circuit**
	3. closed circuit
 |

1. Describe the principle of operation of a Residual Current Device. (2)

If the Current in the Active wire is different to the Current in the Neutral line the device trips the circuit and disconnects the supply voltage

13. Correctly match each parameter with the unit of measurement. (6)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Amount of Substance | a | 1231236123123 | 2 | Kelvin |
| Electric Current | b | 3 Ampere | 6 | Mole |
| Length  | c | 4 Metre | 3 | Ampere |
| Luminosity | d | 7 Candela | 5 | Kilogram |
| Mass | e | 5 Kilogram | 7 | Candela |
| Temperature | f | 2 Kelvin | 1 | Second |
| Time | g | 1 Second | 4 | Metre |

1. Identify the value of a four colour band resistors which has the following colours

 (1)

Yellow Violet Red Gold

* 1. 47kΩ 20%
	2. 4k7Ω 20%
	3. 47kΩ 5%
	4. 4k7Ω 5%
1. Given  and I = 10 mA and R = 1 kΩ Find V (3)



V = 10\*10-3 \* 1 \* 103

V = 10 V

# Complete the following table by using Ohm’s law to calculate the missing values in each row. (12)

|  |  |  |  |
| --- | --- | --- | --- |
| VOLTAGE | CURRENT | RESISTANCE | POWER |
| 12 V | 16 mA | 750 | 192 mW |
| 9 V | 6 mA | 1k5Ώ | 54 mW |
| 39.6 V | 1µ2A | 33MΏ | 47.52 µW |

Calculations:

R3

R2

R1

*Figure 5*

# Questions 16 to 21 refer to Figure 5

1. If R1 = 1K Ώ R2 = 5K6 Ώ R3 = 100 Ώ

Calculate the total resistance (2)



1. If R1 = 125 Ώ R2 = 250 Ώ R3 = 225 Ώ

# Calculate the total resistance (2)



# If R1 = 125 Ώ R2 = 250 Ώ R3 = 225 Ώ VIN = 60V

# Calculate the value of IR3 (2)



 (117)

# If R1 = 125 Ώ R2 = 250 Ώ R3 = 225 Ώ VIN = 60V

# Calculate the value of PT (2)



# If R1 = 125 Ώ R2 = 250 Ώ R3 = 225 Ώ VIN = 60V

# Calculate the value of VR2 (2)



# If VR1 = 10V VR2 = 3V VR3 = 25V

# Calculate the value of VIN (2)





V1

V2

V3

Figure 6

Questions 22 to 24 refer to Figure 6

# If R1 = 10k Ώ R2 = 50k Ώ R3 =100k Ώ VIN = 60V

# Calculate the values of (5)

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | V1 = VS = 60V | 1 Mark |

|  |  |  |  |
| --- | --- | --- | --- |
| V2 = | 2 marks | V3 = | 2 Marks |

# Refer to the question ABOVE if the value of R1 is increased to 20kΏ (1)

## Only V1 would change

## Only V2 would change

## Only V3 would change

## V2 and V3 would change

# This type of circuit is commonly called a: (1)

## Current divider

## Voltage divider

## Voltage regulator

## Current regulator

1. State the theory of the conservation of energy. (2)

|  |
| --- |
| Energy cannot be created or destroyed. |
| It can only be converted from one form to another |
|  |

1. Calculate the efficiency of a device that consumes 100W of energy and has a resultant output of 65W. Show formula. (2)

|  |
| --- |
| Efficiency = $\frac{Output Power}{Input power}$ X 100 Efficiency = $\frac{65 Watts}{100Watts}$ X 100 Answer = 65% |

1. Define static electricity (1)

|  |
| --- |
| Electric charge accumulated on an insulated body. Addition of electrons creates a |
| negative charge and depletion of electrons creates a positive charge. |

1. Define current electricity (1)

|  |
| --- |
| Current electricity is a flow of electrons through a conductive material. |
|  |

1. Describe why electricity is distributed long distances via high voltage (2)

|  |
| --- |
| To minimise losses in the transmission. High voltage transmission results in lower  |
| current. Power consumed by resistance in the line is calculated by the formula  |
| $I^{2}$x R. Therefore the lower the current the less the power consumed in the line. |

1. State what electrical supply is required to operate the following equipment.

(4)

|  |  |
| --- | --- |
| Electric heater | 240V AC |
| iPad | Low Voltage DC (Battery) |
| Fluorescent light | 240V AC |
| Cordless drill | Low Voltage DC (Battery) |

1. Energy is defined as: (2)

|  |  |
| --- | --- |
| A | Energy is Newtons per square metre |
| B | Energy is power per second |
| C | Energy is the ability to do work |
| D | Energy is Pascals per ampere |

32. What minimum power rating resistor would be required in a circuit where a 12Volt supply is connected to a 48 Ώ resistor. (1)

|  |  |
| --- | --- |
| A | ½ Watt |
| B | 1 Watt |
| C | 5 Watt |
| D | 10 Watt |

33. A potentiometer with the markings 10kΏ (A) would have a reading of how many ohms at 50% rotation. (1)

|  |  |
| --- | --- |
| A | 2k5Ώ |
| B | 7k5Ώ |
| C | 5kΏ |
| D | 10kΏ |

34. A 10Ώ - 5 Watt resistor is most likely. (1)

|  |  |
| --- | --- |
| A | Carbon Film |
| B | Wire Wound |
| C | Metal Film |
| D | Metal Oxide |

35. What effect would a rise in temperature have on the resistance value of a positive temperature co-efficient resistor (PTC). (1)

|  |  |
| --- | --- |
| A | Resistance would increase |
| B | Resistance would remain the same |
| C | Resistance would be infinity |
| D | Resistance would decrease |

36. Can a primary cell be recharged (1)

|  |  |
| --- | --- |
| Yes/No |  |

37. What is the voltage output of each cell of a car battery. (1)

|  |  |
| --- | --- |
| A | 1.5V |
| B | 2.1V |
| C | 3.7V |

38. What device could be used to operate an automatic light top turn on when the ambient light decreases below a certain level (1)

|  |  |
| --- | --- |
| A | A VDR (voltage dependent resistor) |
| B | An LDR (light dependent resistor) |
| C | An NTC (negative temperature co-efficient resistor) |
| D | A Rheostat |