

ELECTROTECHNOLOGY
ELTK1100
ASSIGNMENT #1
SOLUTIONS

1. The six ways to generate EMF are:

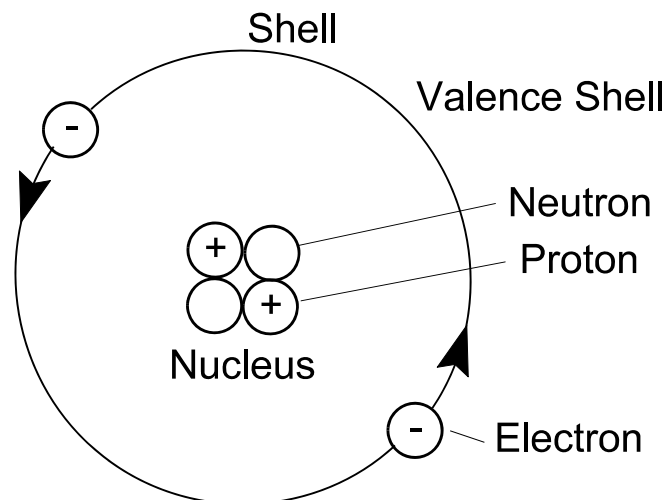
- | | |
|------------|---------------------|
| - Chemical | Battery. |
| - Magnetic | Generator. |
| - Heat | Thermocouple. |
| - Light | Photoelectric Cell. |
| - Pressure | Piezoelectric Cell. |
| - Friction | Static Electricity. |

2. Potential Difference.

3. Repel. Unlike charges Attract. Like charges Repel.

4. An atom is the smallest piece of an element that can exist and still have the characteristics of the element.

The particles of an atom are: Neutrons, Protons and Electrons.



5. The electron arrangement in shells for Copper is 2 - 8 - 18 - 1. The electron arrangement in shells for Silver is 2 - 8 - 18 - 18 - 1. Both metals have one electron in the valence shell.

The single electron in the valence shell is far from the nucleus (in atomic terms) and it is not tightly held by the attractive force of the positive protons (in the nucleus). This means that it is free to move with only a little external energy. This easy mobility accounts for the good conductive properties of copper and silver.

6. EMF or Electromotive Force is the source of electrical energy which causes electrons to move through a conductor.

7.

First Band	Second Band	Multiplier	Tolerance	Resistor Value
Red	Brown	Orange	Silver	21kΩ 10%
Brown	Black	Brown		100Ω 20%
Green	Blue	Gold	Silver	5.6Ω 10%
Violet	Grey	Red	Gold	7.8kΩ 5%
White	Red	Green		9.2MΩ 20%
Orange	Orange	Silver	Gold	0.33Ω 5%
Blue	Green	Red		6.5kΩ 20%
Grey	Yellow	Gold	Gold	8.4Ω 5%
Yellow	Violet	Yellow	Silver	470kΩ 10%
Brown	White	Black		19Ω 20%

8.

Resistor Value	First Band	Second Band	Multiplier	Tolerance
1.3kΩ 10%	BROWN	ORANGE	RED	SILVER
78kΩ 20%	VIOLET	GREY	ORANGE	NO COLOR
0.1Ω 5%	BROWN	BLACK	SILVER	GOLD
910kΩ 20%	WHITE	BROWN	YELLOW	NO COLOR
0.39Ω 5%	ORANGE	WHITE	SILVER	GOLD
220Ω 10%	RED	RED	BROWN	SILVER
0.82kΩ 5%	GREY	RED	BROWN	GOLD
47Ω 10%	YELLOW	VIOLET	BLACK	SILVER
0.68MΩ 20%	BLUE	GREY	YELLOW	NO COLOR
5.4Ω 5%	GREEN	YELLOW	GOLD	GOLD

9.

Name of the Electrical Term	Symbol for Term	Measurement Unit	Measurement Abbreviation	Measurement Instrument
EMF	V_T	VOLT	V	VOLTMETER
Current	I	AMPERE	A	AMMETER
Resistance	R	OHM	Ω	OHMMETER

10. A 220Ω resistor with 10% tolerance means the worst case range for the resistor relative to the color coded value is:

$$220\Omega \pm 10\% = 220\Omega \pm 22\Omega$$

Therefore the resistance of the part is guaranteed (by the manufacturer) to be between $220\Omega - 22\Omega = 198\Omega$ and $220\Omega + 22\Omega = 242\Omega$.

11.

$$I = \frac{q}{t} = \frac{9mC}{6s} = \frac{9 * 10^{-3}C}{6s} = 1.5 * 10^{-3}A = 1.5mA$$

$$\begin{aligned} \# \text{ of electrons} &= q * \frac{6.25 * 10^{18} \text{ electrons}}{C} \\ &= 9mC * \frac{6.25 * 10^{18} \text{ electrons}}{C} \\ &= 9 * 10^{-3}C * \frac{6.25 * 10^{18} \text{ electrons}}{C} \\ &= 5.63 * 10^{16} \text{ electrons} \end{aligned}$$

12.

$$q = +2.3\mu C - (-1\mu C) = 3.3\mu C$$

$$\begin{aligned} \# \text{ of electrons} &= q * \frac{6.25 * 10^{18} \text{ electrons}}{C} \\ &= 3.3\mu C * \frac{6.25 * 10^{18} \text{ electrons}}{C} \\ &= 3.3 * 10^{-6}C * \frac{6.25 * 10^{18} \text{ electrons}}{C} \\ &= 2.06 * 10^{13} \text{ electrons were removed the socks.} \end{aligned}$$

13.

Electrical Quantity	Integer/Decimal #	Scientific Notation in Powers of 10
0.035 Megahertz	35,000	$3.5 * 10^4$
Giga means	1,000,000,000	$1 * 10^9$
Nano means	0.000,000,001	$1 * 10^{-9}$
0.0065 Megaohm	6,500	$6.5 * 10^3$
14.31818 Megahertz	14,318,180	$1.431818 * 10^7$
50 Kilovolts	50,000	$5 * 10^4$
0.005 Millifarad	0.000,005	$5 * 10^{-6}$
850 Picofarad	0.000,000,000,85	$8.5 * 10^{-10}$
5.6 Microfarad	0.000,005,6	$5.6 * 10^{-6}$

14.

330 kΩ	0.33 MΩ	330,000 Ω
0.00002 F	20 μF	20,000,000 pF
0.2 mA	0.000,2 A	200 μA
0.05 A	50,000 μA	50 mA
470 MΩ	470,000,000 Ω	470,000 kΩ
10 kV	0.01 MV	10,000,000 mV
56000000 Ω	56 MΩ	56,000 kΩ

15.

$$I = \frac{V_T}{R} = \frac{10V}{500\Omega} = 0.02A = 20 * 10^{-3}A = 20mA$$

16.

$$R = \frac{V_T}{I} = \frac{120V}{25\mu A} = \frac{120}{25 * 10^{-6}} = 4.8 * 10^6 \Omega = 4.8M\Omega$$

17.

$$V_T = IR = 0.75mA * 0.2M\Omega = 0.75 * 10^{-3} * 0.2 * 10^6 = 150V$$