Assignment

NAME : Muhammad HAROON
Course title : Applied physics
Student ID : 16216
Summer final term 2020

Q1 : (a) What is meant by the term work done? Derive equations for positive and negative work done.

Ans:

Physics, work is the process of energy transfer to the motion of an object via application of a force; often represented as the product of force and displacement. A force is said to do positive work if (when applied) the force has a component in the direction of the displacement at the point of application of the force.

Common Symbols
W
SI unit
Joule (J)
other units
Foot-pound, Erg
In SI base units
1 kg·m2·s-2
Derivations from other quantities

ID: 16216 Name: M. HAROON

$W = F \cdot S$

$W = \tau\theta$

Dimension

$M L^2 T^{-2}$

The SI unit of work is the joule (J).

⟺

Q2: (b) An object weighing 32N is pulled with a force of 45N with a rope which is making an angle of 45 degress with the direction of motion of the object. The object moves 50 meters along the ground, calculate the work done in pulling the object?

Ans:

Given Data:

$F = 32\ N$

$\theta = 45^{\circ}$

$S = 50\ m$

Required

work = ?

Solution:

we know that work by formula

$W = F \cos\theta \times S$

ID: 16216 Name: M·HAROON

Putting value "F" "θ" & "S"

$$w = 32 \times \cos 45^\circ \times 50$$

$$w = 22.627 \times 50$$

$$w \simeq 1131.37\,J$$

⟺

ID: 16216 Name: M. HAROON

Q2: (a) state and mathematically explain colomb's law. Apply coulomb's law to discuss role of the material medium In between the charges?

Ans: Coulomb's law state that;

The magnitude of the electric force between two point charges is directly proportional to the product of the charges and inversely proportional to the square of the distance between them.

In mathematical term, the magnitude F of the force that each of two point charge q_1 and q_2 a distance r apart exerts on the other can be expressed as;

$$F = k \frac{|q_1 q_2|}{r^2}$$

where k is a constant.

Electric constants, k

In SI units the constant, k is $1/4\pi\epsilon_0$ where (ϵ_0 - epsilon nought or epsilon zero)

$$k = 8.988 \times 10^9 \ N \cdot m^2/C^2$$

ID: 16216 Name: M.HAROON

By approximation

$$k = 9.\otimes \times 10^{9} \; N \cdot m^2 / C^2$$

$\Longleftrightarrow$

ID: 16216 Name: M. HAROON

Q2:(b) Explain using diagrams and mathematical expressions concept of electric flux.

Ans: Electric flux:
The measure of flow of the electric field through a given area. It is proportional to the number of electric field lines going through a normally perpendicular surface.
For electric field $\vec{E}$ passing through an area $\vec{A}$, the flux passing through it is $\vec{E}.\vec{A}$.
According to Gauss' law, flux passing through a closed surface is proportional to the amount of charge in the enclosed volume.

$$\vec{E}.\vec{A} = \frac{q_{enc}}{\epsilon_0}$$

Let us take a cylindrical surface co-axial with the charge carrying straight wire as Gaussian surface.
Enclosed charge in this volume as shown in figure, assuming linear charge density to be λ, is

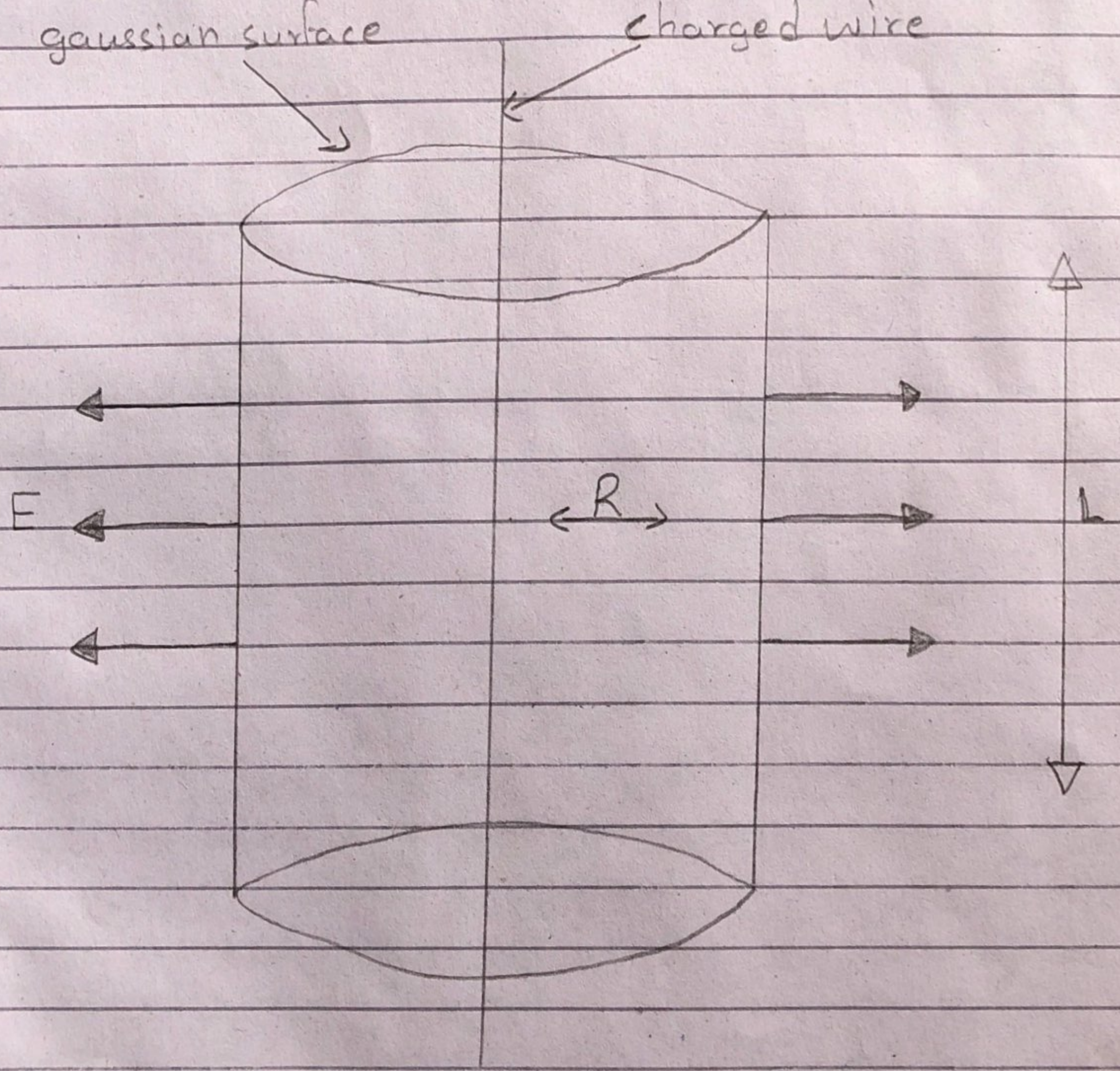
$$q_{enc} = \lambda L$$

ID: 16216 Name: M. HAROON

Hence according to the Gauss' law.

$$E(2\pi R L) = \frac{\lambda L}{\epsilon_0}$$

$$\Rightarrow E = \frac{\lambda}{2\pi \epsilon_0 R}$$



ID:16216 Name: M.HAROON

Q3.(a) Describe the existence of magnetic force on electric current carrying conductor in a magnetic. Obtain equation for the force.

Ans: When an electrical wire is exposed to a magnet, the current in that wire will experience a force - the result of magnet field.

- The force (F) a magnetic field (B) exerts on an individual charge (q) traveling at drift velocity vd is:

$$F = qv_dB \sin\theta$$

In this instance, θ represents the angle between the magnetic field and the wire (magnetic force is typically calculated as a cross product). If B is constant throughout a wire and is 0 elsewhere, then for a wire with N charge carriers in its total length l, the total magnetic force on the wire is:

$$F = Il B \sin\theta$$

The direction of the magnetic force can be determined using the right hand rule, demonstrated in.

ID: 16216 Name: M. HAROON

The thumb is painting in direction of the current, with the four other fingers parallel to the magnetic field curling the fingers reveals the direction of magnetic force.

⟺

ID: 16216 Name: M. HAROON

Q3:(b) What is the force per meter length on a wire carrying 1.2 A current in a 0.75 T magnetic field?

Ans: Given Data:

$I = 1.2 A$

$B = 0.75 T$

$L = 1 m$ ∵ Per meter length

Required:

$F = ?$

Solution:

by formula
for maximum force.

$F = BIL \sin\theta$

• $\sin(90) = 1$ max

$F_B = BIL$

$\Rightarrow (0.75)(1.2)(1)$

$F_B = 0.9 N.$

⟺

ID: 16216 NAME: M.HAROON

Q4:(a) Give electrical classification of solids, give three examples for each type of material.

Ans:

Classification of solids

↓ Crystallin solids

↓ Amorphous solids
Ex: Glass, rubber etc

⇒ Ionic crystalls Ex: Nacl, kcl.
⇒ Covalent crystalls Ex: Diamond, SiO_2.
⇒ Molecular crystalls Ex: napthalene, anthoracene, glucose.
⇒ Metallic crystals Ex: All metallic elements (Na, Mg, Cu, Au, Ag).
⇒ Atomic solids – Ex: Frozen elements of group 18.

⟺

Q4:(b) Distinguish between intrinsic and extrinsic semiconductors. Give example of each material used for these purposes.

Ans: Intrinsic semiconductor:-

1:- Semiconductor in a pure form is called

ID:16216 Name: M.HAROON

Intrinsic semiconductor.

2:- Here the change carries are produced only due to thermal agitation.

3:- They have low electrical conductivity.

4:- They have low operating temperature.

5:- At ok, Fermi level exactly lies between conduction band and valence band.

Example:-

Si, Ge etc.

Extrinsic semiconductor:-

1:- Semiconductor which are doped with impurity is called extrinsic semiconductor.

2:- Here the change carries are produced due to impurities and may also be produced due to thermal agitation.

3:- They have high electrical conductivity.

4:- They have high operating temperature.

5:- At ok, Fermi level exactly lies closer to conduction band in "n" type semiconductor and lies near valence band in "P" type semiconductor.

Example:-

Si and Ge doped with Al, In, P, As etc.

ID: 16216 Name: M. HAROON

Q5: What is photoelectric effect? How it is experimentally studied? What are the major features of photoelectric effect, describe by giving examples?

Ans: Photoelectric effect, phenomenon in which electrically charged particles are released from or within a material when it absorbs electromagnetic radiation. The effect is often defined as the ejection of electrons from a metal plate when light falls on it. In a broader definition, the radiant energy may be infrared, visible, or ultraviolet light, x rays, or gamma rays; the material may be a solid, liquid or gas; and the released particles may be ions (electrically charged atoms or molecules) as well as electrons. The phenomenon was fundamentally significant in the development of modern physics because of the puzzling questions it raised about the nature of light-particles versus wavelike behavior- that were finally resolved by Albert Einstein in 1905. The effect remains important for research in areas from materials science to astrophysics, as well as forming the basis for a variety of useful devices.

ID: 16216 Name: M.HAROON

Photoelectric Effect

Experiments showed that light directed onto a metal surface causes the surface to emit electrons.
This phenomenon is called photoelectric effect.

Three feature of photoelectric effect:

1:- The electron is always emitted at once even under a faint light.
2:- A bright light causes more electrons to be emitted than the faint light, but the average kinetic energy of the electrons is the same.
3:- The higher the light frequency, the more kinetic energy the electrons have.

Example 1:-

Solar plants are nothing more than a series of metalic plates that face the sun and exploit the photoelectric.

Example: 2:-

• The photoelectric effect is commonly used to measure light. camera

ID: 16216 Name: M. HAROON

light meter.

- It can also generate electricity.

photoelectric cell.

⟺