Name Waqas Bangash
Assignment Applied physics
ID 16323
Summer Final Term

QI Part (a)

(a) What is meant by the team 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 of the point of application of the force.

Common symbols.
W
SI Unit
Joule (J)
other Units
Foot-pound, erg
In SI base Units
$1\ kg \cdot m^2 \cdot s^{-2}$
Derivations from other quantities
$W = F \cdot S$
$W = \tau\theta$
Dimension
$ML^2T^{-2}$

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

Q2 a. State and mathematically explain coulomb'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 b/w 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:

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

When k is a constant.

Electric constants, k

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

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

by appromximation.

$$k = 9.0 \times 10^9 N.m^2/C^2.$$

Q: Part (b)

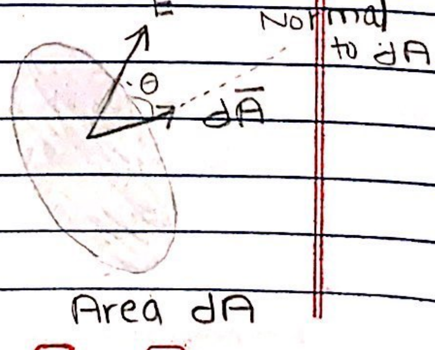
(b) Explain using diagrams and ~~material~~ mathematical expressions concept of electric flux.

Ans **Electric flux :-**

Consider a small flat Area dA.
Let $\bar{E}$ be the electric field at its centre.
Assume that dA is so small that $\bar{E}$ can be regarded as uniform over the whole of dA.

**Defination :-**

The electric flux $d\Phi$ through the Area dA is the product of dA and the normal Component of $\bar{E}$.






Scanned with CamScanner

or $d\Phi = (E\cos\theta)\, dA$ so

$$d\Phi = \bar{E} \cdot d\bar{A}$$

where $d\bar{A}$ is the Normal vector of the Area $dA$:

Magnitude of $d\bar{A} = dA$

Direction of $d\bar{A}$ is perpendicular to $dA$

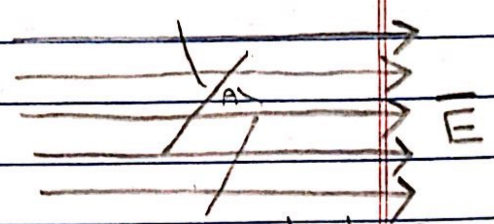
Note. 1 Electric flux is a scalar.

2. The electric flux through area $dA$ can be throught of as the number of field lines crossing $dA$.

$d\Phi = E(d\cos\theta)$

= (No. of lines/unit area)(Projected Area)
(Area $dA$ seen edge-on)

= No. of lines crossing $dA$




Projected Area
$dA\cos\theta$

So far we're considered a uniform field passing through a flat surface.

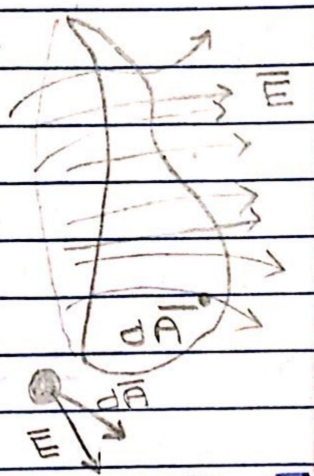
## General Case:

Consider a Non-Uniform field E passing through a Non-Flat surface, A.
Divide A into many small elements (patches) such as dA.

dA is small ⇒

① its approximately flat.

② $\bar{E}$ is uniform dA.




⇒ Flux through dA is $d\Phi = \bar{E} \cdot d\bar{A}$

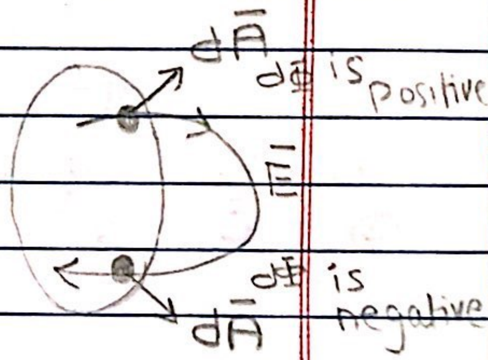
to find the total flux through the whole surface. we intergrate over the whole of the area A:

$$\Phi = \int_A \bar{E} \cdot d\bar{A}$$

Note: 1 By convention $d\bar{A}$ is taken to point outwards from the surface.

2. If the Angle between $\bar{E}$ and $d\bar{A}$ is $< 90°$ than $d\Phi$ is positive.

If the angle between $\bar{E}$ and $d\bar{A}$ is $> 90°$ than $d\Phi$ is negative.



QI Part (b)

(b) Answer:

Given Data

$F = 32N$

$\theta = 45°$

$S = 50m$

Required

work = ?

**Solution:**

we know that work by formula

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

Putting value "F" "θ" & "S"

$W = 32 \times \cos 45° \times 50$

$W = 22.627 \times 50$

$W = 1131.37 J$

Q3 Part (b)

(b) Answer:

Given Data.

$I = 1.2\ A$

$B = 0.75T$

$L = 1m$ ∵ Per Meter length

Required:

$F = ?$

Solution:

by formula for maximum force.

$F_B = BIL\sin\theta$

• $\sin(90) = 1$ max

$F_B = BIL$

=> $(0.75)(1.2)(1)$

$F_B = 0.9\ N$.

Q3 Part (a)

(a) Answer :-

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

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

$$F = IlB \sin\theta$$

The direction of the magnetic force can be determind using the right hand rule, demonstrated in. The thumb is pointing in direction of the current, with the four other fingers parallel to the magnetic field curling the fingers reveals the direction of magnetic force.

Q4 Part (a)

(a) Answer :-

**Classification of Solids**

- Crystallin Solids
- Amorphous solids
  Ex: Glass, rubber etc

⇒ Ionic crystals Ex: NaCl, KCl.

⇒ Covalent crystals Ex: Diamond, $SiO_2$.

⇒ Molecular crystals Ex: naphthalene, anthracene, glucose.

⇒ Metallic crystals Ex: All metallic elements (Na, Mg, Cu, Au, Ag)

⇒ Atomic solids - ex: Frozen elements of group 18.

Q4 Part (b)

(b) Answer :-

Intrinsic Semiconductor :-

1- Semiconductor in a pure form is called intrinsic semiconductor.
2- Here the change carriers are produced only due to thermal agitation.
3- They have low electrical conductivity.
4- They have low opreating temperature.
5- At 0K, Fermi level exactly lies b/w 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 carriers 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.

Q5

Answer :.

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 defination, the radiant energy may be infraed visable, or ultraviolet light, X-rays, or gamma rays; and the released particles may be ions (electrically charged atoms or molecules) as well as electrons. The phenomenon was fundamentally significent in the development of modern physics because of the puzzling questions it raised about the nature of light particle versus wavelike behaviour- 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.

## Photoelectric Effect:

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

## 3 features of photoelectric effect:-

- The electron is always emitted at once even under faint light.
- A bright light cause more electrons to be emitted than faint light, but the average kinetic energy of the electrons is the same.
- 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 light meter.
- it can also generate electricity. photovoltaic cell.